



North Carolina Ecosystem Enhancement Program October, 2010

This document was prepared by Hal Bryson and Mike Herrmann, NC EEP Watershed Planning -- with input from several of the Indian Creek and Howards Creek LWP stakeholders. Special thanks to Robert Carson (Lincoln County Planning & Inspections) and Rick McSwain (Lincoln Soil & Water Conservation District) for their assistance in developing many of the recommendations contained in Section IV of this document.

Cover photo: West Lincoln High School, proposed stormwater BMP site.

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EXECUTIVE SUMMARY

The purpose of this *Watershed Management Plan* is to present the results of the Indian Creek and Howards Creek Local Watershed Planning (LWP) initiative. The results of LWP Phases I and II (preliminary watershed characterization and detailed assessment, respectively) are documented in NC EEP's *Preliminary Findings Report* (December 2008) and *Watershed Assessment Report* (March 2010) – see http://www.nceep.net/services/lwps/Indian_Howards_Creek/2010/ReportLinks.pdf. This Plan is the culmination of a two-year collaborative effort to identify and prioritize solutions for the most critical watershed problems within the LWP study area. The *Watershed Management Plan* and the *Project Atlas* represent the final products produced for this planning effort, upon completion of Phase III. This document includes a summary of the priority watershed projects included in the *Project Atlas* (see Section IV).

The major elements of the Plan include:

- **Section I Introduction**: an overview of the NC EEP mission and local watershed planning, and background on the Indian Creek and Howards Creek watersheds;
- **Section II Stakeholder Involvement**: a summary of the stakeholder process, including meetings held and key input obtained from stakeholder subgroups;
- **Section III Watershed Characterization**: a summary of the watershed assessment methods and results, including major stream and wetland stressors and sources;
- Section IV Plan Recommendations: a summary of top-ranked projects in the Project Atlas, a
 discussion of best management practices (BMPs) and a detailed set of institutional measures
 recommended to improve or protect local watershed resources;
- **Section V Watershed Plan Implementation**: a recommended strategy for effectively implementing Plan recommendations; and
- **Section VI Technical Resources & Funding Sources**: websites and documents providing additional information for many of the watershed management/protection tools discussed in the Plan.

The primary stressors to local watershed functions (identified during Phases I and II of this LWP initiative) and the management strategies recommended to address them are summarized in Table ES-1. The major watershed stressors, their impacts and where they are most significant (i.e., where their sources are most concentrated across the subwatersheds and/or where there are no management measures in place to control/limit them) are often overlapping in time and space. Most of the stressors identified are associated with specific land uses and/or land cover types. Some stressors (e.g., impervious cover and stormwater runoff) are more pronounced within urban or urbanizing subwatersheds. Others (e.g., livestock access to streams) are associated with predominantly rural/agricultural subwatersheds. One stressor activity (stream channelization and dredging) occurred historically within portions of the LWP study area but is no longer practiced as a general rule. Watershed management strategies recommended to minimize/control the stressors or aid in the restoration of stressor-impacted streams and wetlands include a mix of specific watershed project sites [including restoration, enhancement, preservation and best management practices (BMP) projects] as well as broader institutional measures that may be applied watershed-wide to more effectively protect and/or restore local watershed resources.

Establishment of a local watershed council or advisory team is recommended so that a coordinated strategy for the long-term implementation of the various elements of the Plan can be pursued. The Lincoln Soil & Water Conservation District (or other local sponsor) is encouraged to pursue grant funding to hire a Local Watershed Coordinator to oversee these efforts. The Lincoln Natural Resources Committee (LNRC) has been identified as the most logical group to establish a subcommittee to focus on the development and implementation of a local Watershed Education Plan. Without a concerted effort to increase the awareness and understanding of key watershed problems and possible solutions by county residents, developers/builders, elected official and schools, many of the recommendations within the Plan will be difficult or impossible to achieve.

Table ES-1. Summary of Major Watershed Stressors, Functional Impacts and Applicable Management Strategies.

WATERSHED STRESSORS	FUNCTIONAL IMPACTS	WHERE MOST SIGNIFICANT	APPLICABLE MANAGEMENT STRATEGIES
Channelization and stream dredging [Hydrologic modification]	Channel incision & bank erosion; draining of riparian wetlands; lowering of water table; bypassing of buffer & floodplain functions; degraded aquatic habitat	Lower Indian Creek; Howards Creek; Middle South Fork Catawba	Stream and riparian buffer restoration/enhancement projects; watershed education; enforcement of existing rules/ordinances
Incised channels; unstable stream banks	Contributes to water quality impairment and aquatic habitat degradation (e.g., embedded riffles, filling of pools, loss of substrate heterogeneity); loss of arable land	Throughout; especially upper Howards Creek	Stream and riparian buffer restoration/enhancement; preservation of upstream reaches; stormwater and agricultural BMPs; adoption of county-wide stormwater ordinance
Degraded/deforested riparian buffers	Stream bank instability, poor stream shading, lack of woody material in streams, suppressed pollutant removal functions	Throughout; especially Howards Creek	Stream and riparian buffer restoration/enhancement; wetland restoration/enhancement; agricultural BMPs; preservation of existing high-quality stream reaches (riparian corridors); enforcement of buffer ordinance; watershed education; Greenways planning; stream mapping
Degraded wetlands (drained, cleared; invasive vegetation)	Habitat loss/degradation, loss of pollutant removal (filtration/transformation) functions	Lower Indian Creek; lower Howards Creek; Middle South Fork	Stream and riparian buffer restoration/enhancement; wetland restoration/enhancement; agricultural BMPs (e.g., livestock exclusion); preservation of existing intact wetlands
Livestock access to riparian buffers & streams	Bacterial contamination of streams, stream bank instability, increased sediment, fecal and nutrient inputs to streams	Throughout (agricultural lands; beef and dairy farms)	Stream and riparian buffer restoration/enhancement; agricultural BMPs (e.g., livestock fencing + provision of alternate watering sources, shade structures); watershed education
Fecal coliform and nutrient inputs	Degraded water quality and human health risks	Throughout (esp. agricultural lands, farms, residential areas w/poor buffers)	Stream and riparian buffer restoration/enhancement; wetland restoration/enhancement; agricultural BMPs (e.g., livestock exclusion); watershed education; Source Water Protection planning and education
Impervious cover and stormwater runoff	Channel and bank instability (erosion), including streambed scour; increased inputs of sediment, nutrients and other urban pollutants (e.g., metals)	Middle Indian Creek (e.g., W. Lincoln High School); lower Indian Creek (Cherryville area); expanding urban/residential areas	Stream and riparian buffer restoration/enhancement; stormwater BMP projects; watershed education; monitoring and enforcement of WSW rules; adoption of county-wide stormwater ordinance; incorporation of stormwater BMPs into Greenways planning & design; Source Water Protection planning
Accelerated soil erosion and sedimentation from upland sites	Loss of aquatic habitat, increased turbidity and input of attached pollutants, increased costs of water treatment	Throughout (construction sites, new developments, areas of logging & clearing)	Preservation of critical upland sites/areas; agricultural BMPs; watershed education; monitoring and enforcement of erosion/sediment control ordinance; amend existing ESC and/or WSW ordinances to address sites under 1 acre in size

Note: many of the stressors occur in a sequential, interrelated manner – for instance, past stream channelization (the original stressor) has led to channel incision and stream bank instability (secondary stressors), which in turn lead to increased inputs of sediment (a 'third-generation' stressor) to the stream – producing impacts to both water quality and aquatic habitat. Stream channelization and deepening/dredging is often accompanied by clearing of the riparian buffer zone and/or creation of artificial berms bordering the stream channel (which represent another set of stressors to watershed functions).

LIST OF ACRONYMS & ABBREVIATIONS

BI Biotic Index

BMPs Best Management Practices

CFU/100 ml Colony Forming Unit/100 milliliters

CGIA Center for Geographic Information and Analysis

CWP Center for Watershed Protection

DO Dissolved Oxygen

EPT Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies)

EPT BI EPT Biotic Index

GIS Geographic Information System IBI Index of Biological integrity

L (or l) Liter

LID Low Impact Development LWP Local Watershed Plan

MG (or mg) Milligram

NC DENR NC Department of Environment and Natural Resources

NC DFR
NC Division of Forest Resources
NC DLR
NC Division of Land Resources
NC DOT
NC Department of Transportation
NC DWM
NC Division of Waste Management
NC DWQ
NC Division of Water Quality

NC EEP NC Ecosystem Enhancement Program

NC NHP NC Natural Heritage Program

NC WRC NC Wildlife Resources Commission
NLCD National Land Cover Database

NPS Nonpoint Source NR Not Rated

NRCS Natural Resources Conservation Service

PQL Practical Quantitation Limit

SR Secondary Road

SWCD Soil and Water Conservation District

TN Total Nitrogen
TP Total Phosphorus
TSS Total Suspended Solids

USDA United States Department of Agriculture
USFWS United States Fish and Wildlife Service
Tr NCDWQ Trout Waters classification
USEPA US Environmental Protection Agency

μS/cm MicroSiemen/centimeter (a measure of conductivity in water samples)

USGS US Geological Survey WSW Water Supply Watershed

I. INTRODUCTION

This Section provides an overview of the North Carolina Ecosystem Enhancement Program (NC EEP) and its Local Watershed Planning (LWP) initiatives. It also provides background on the selection of the Indian Creek and Howards Creek watersheds as the LWP focus area, and summarizes the goals and objectives of the LWP effort.

NC EEP Background

The NC Ecosystem Enhancement Program (EEP) was created in 2003 to provide ecologically effective compensatory mitigation for permitted impacts to streams, wetlands and riparian buffers under the Clean Water Act. The cornerstone of EEP's approach to compensatory mitigation is the identification of high-

priority local watersheds (14-digit Hydrologic Units) within which a detailed assessment of watershed conditions is accomplished through a stakeholder-driven Local Watershed Planning (LWP) process. EEP mitigation projects are designed to address the major watershed stressors occurring at a sub-watershed scale within high-priority ("targeted") local watersheds. The primary purpose of EEP mitigation projects is the restoration or protection of key watershed functions, including water quality, hydrology and habitat.

For additional information about the NC EEP program mission and operations, including watershed planning and project implementation, go to http://www.nceep.net/abouteep/watershed planning project control.htm.

NC EEP Local Watershed Planning Approach

The primary goal of NC EEP Local Watershed Planning is to provide a watershed-based approach for the identification and implementation of mitigation projects. A detailed assessment of watershed problems and assets at the local scale (14-digit Hydrologic Units, or HUs) forms the basis for specific recommendations for restoring/enhancing and protecting local water quality, hydrology and habitat. A local watershed stakeholder team assists in the identification and ranking of watershed solutions, including specific project sites and broader institutional measures.

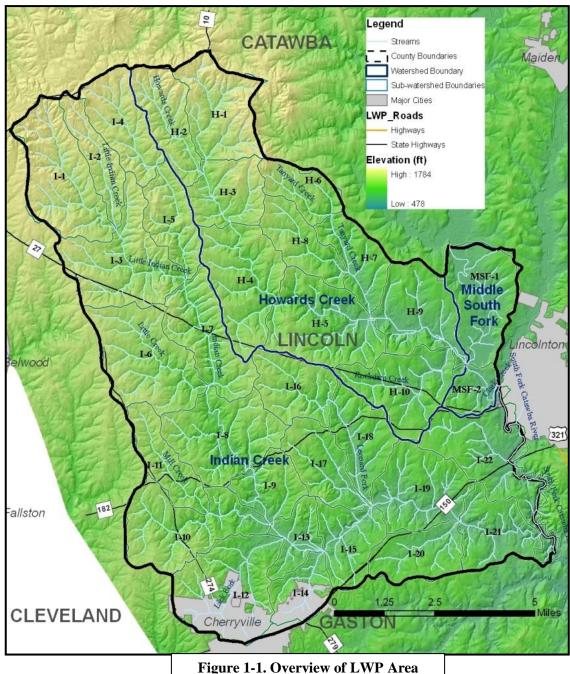
The EEP Local Watershed Planning process includes three major phases of work. Phase I is the preliminary characterization of watershed conditions, based primarily on GIS data and existing water quality and habitat information, including some field reconnaissance. Phase II includes field assessment activities and the identification of potential restoration/enhancement and preservation sites within priority sub-watersheds. Watershed modeling is another typical component of the Phase II or III work. Phase III integrates watershed assessment data and stakeholder recommendations in the development of two final LWP products: a *Project Atlas* of ranked watershed project sites (e.g., stream and wetlands restoration/enhancement and preservation projects, as well as high-priority urban and rural BMP projects); and a *Watershed Management Plan* [this document], consisting of consensus recommendations for consideration by local governments, resource agencies, and watershed citizens or groups seeking to protect watershed resources and functions.

For more information on EEP's LWP initiatives across the state, go to http://www.nceep.net/pages/lwpguide.htm.

Planning Area Description

This LWP initiative focused on three 14-digit HUs draining a total area of 114 square miles, primarily in western Lincoln County: Indian Creek (03050102050010); Howards Creeks (03050102040040); and middle South Fork Catawba River (03050102040030). These watersheds were selected as an LWP focus area by EEP in early 2008 on the basis of several factors, including: (1) a mix of land use and land cover conditions, affording ample opportunities for stream and wetlands restoration projects to help meet programmatic mitigation needs in the lower Catawba River basin; (2) willingness of local resource professionals to work with EEP in developing a Plan to restore and protect local watershed resources; (3) presence of water supply watersheds and other high-quality resource conditions; and (4) impaired biological conditions (and 303d listing status) in lower Indian Creek.

Figure 1-1 below depicts the LWP study area, including major roads, streams and municipal boundaries. The City of Cherryville in extreme northwestern Gaston County falls along the southern border of the study area and represents the greatest concentration of urban land use within the LWP watersheds.



Indian Creek and Howards Creek LWP Timeline

A summary timeline for the major phases and associated activities conducted during this local watershed planning effort is presented below.

Phase I – this phase began in spring 2008 and included the compilation and review of existing watershed data, including available GIS data sets and historical water quality information. This phase culminated in production of the Phase I Preliminary Findings Report in December 2008, which focused on the preliminary identification of major ecological assets and watershed stressors within the LWP study area, and key data gaps to be filled during Phase II.

Phase II – this phase included the detailed assessment of watershed conditions in the field (conducted primarily by Entrix, Inc. during the spring of 2009) and the water quality monitoring work conducted by DWQ from April 2008 through March 2009 (including biological/benthic sampling in October 2008). The two major end products of this phase were DWQ's *Integrated Analysis Report of Water Quality* (January 2010) and the *Watershed Assessment Report* (April 2010).

Phase III – this phase began in the spring of 2009, when the stakeholders formed specialized subgroups to begin developing watershed management recommendations and when Entrix introduced the multi-criteria decision analysis (MCDA) framework to assist stakeholders in creating a project ranking model. Phase III culminated with production of the *Project Implementation Report & Project Atlas* (NC EEP, 2010b) and the final *Watershed Management Plan* (this document).

Note that the phases of work overlap due to the iterative and flexible nature of watershed assessment and plan development tasks.

For links to all reports produced during the three phases of this LWP initiative, see http://www.nceep.net/services/lwps/Indian_Howards_Creek/2010/ReportLinks.pdf. For a summary of stakeholder involvement activities throughout the three phases, see Section II below.

Phase IV- this phase focuses on procuring signed agreements with interested landowners for permanent easements at priority sites identified in the Project Atlas and was initiated by EEP staff (working with the Lincoln Soil & Water Conservation District) in the summer of 2010. In addition to EEP's pursuit of landowner agreements for the implementation of priority mitigation projects, EEP hopes to continue to work with local stakeholders through the creation of a local watershed advisory committee [see Section V], whose primary mission is to coordinate the funding and implementation of key watershed recommendations identified in this Plan. In fact, the initial meeting of the Indian & Howards Creek Local Watershed Advisory Committee (LWAC), established as a subcommittee within the Lincoln Natural Resources Committee (LNRC), was held in July 2010, with subsequent meetings to be held on a quarterly basis.

Indian Creek and Howards Creek LWP Goals and Objectives

The goals for this LWP effort include those related to EEP's mitigation mission, which are broad goals common to all of EEP's planning initiatives, and the more specific goals and objectives developed in collaboration with the local stakeholder team assembled to support this particular LWP initiative.

EEP Goals - EEP goals for this LWP effort were to (1) conduct a reasonably comprehensive assessment of watershed conditions within the study area; (2) identify the major local watershed assets to be protected and the major ecological stressors to be addressed by mitigation projects and watershed management recommendations; and (3) work collaboratively with local stakeholders to produce a Project Atlas of priority sites for mitigation projects and best management practices (BMPs) – at locations where the greatest benefit to local watershed functions can be achieved -- *and* a final Watershed Management Plan containing consensus recommendations for the restoration, enhancement and protection of local watershed resources.

Stakeholder Goals - The goals of the local stakeholder team were initially formulated in terms of what major issues or concerns within the Indian Creek and Howards Creek watersheds they wanted to be addressed by the LWP process. Eight priority issues were identified during the second stakeholder meeting (June 2008): threats from stormwater; the need for outreach/education on watershed problems and solutions; drinking water protection; water *quantity* issues; agricultural stressors and BMPs;

regulatory/enforcement efforts; erosion/sedimentation and riparian buffers; land conservation & development

Stakeholder Objectives - The eight major stakeholder-identified issues (above) were translated into specific objectives (action items) for the LWP initiative during the third stakeholder meeting (September 2008). These objectives were grouped into three categories, as follows:

Urban

- 1 Identify the best subwatersheds and project sites for stormwater BMPs;
- 2 Develop recommendations for improving stormwater management;
- 3 Seek funding for stormwater BMPs identified through the LWP.

Rural

- 1 Work with rural landowners to implement agricultural BMPs within priority subwatersheds;
- 2 Work with Land Trust(s) to develop a rural preservation strategy.

Watershed-Wide

- 1 Identify priority subwatersheds and rank projects for implementation within these subwatersheds;
- 2 Evaluate the effectiveness of current local ordinances related to watershed protection and develop recommendations to (a) establish new ordinances, as needed, and (b) more effectively enforce existing rules/ordinances:
- 3 Develop a local Watershed Education Program;
- 4 Develop a Source Water Protection Plan for the city of Cherryville.

The LWP stakeholders were then asked (at the fourth meeting in January 2009) to rank in priority order four of the nine objectives they had identified -- specifically, the four objectives/activities that could reasonably be addressed by stakeholder work groups within the remaining LWP timeline of approximately 12 to 16 months. In rank order, these priority objectives were: (1) Development of Stormwater Management Recommendations; (2) Development of a Rural Preservation Strategy; (3) Local Ordinances Review & Recommendations; and (4) Development of a Local Watershed Education Program. See Section II below (Stakeholder Involvement) for further details on the work group activities and objectives. The overall purpose of the work groups formed to address these four priority objectives was to develop consensus recommendations to be included in the final *Watershed Management Plan* (this document).

In addition to the broader watershed goals and objectives developed during LWP Phases I to III, project-specific goals are developed during the development of specific mitigation/restoration plans by EEP's design firms during Phase IV. These goals are developed at the scale of individual project sites and their upstream drainage areas (typically, one to 10 square miles), and are focused on addressing local stream and wetland functional stressors such as missing/degraded riparian buffers, unstable stream banks, inputs of nutrients and sediment from surrounding land uses, uncontrolled livestock access, and excessive stormwater flows and non-point source inputs from developing areas.

II. STAKEHOLDER INVOLVEMENT

A critical component of EEP LWP initiatives is the involvement of local stakeholders, who help in several important ways:

- (1) establishing stakeholder goals and objectives for the LWP work;
- (2) identifying key areas (or 'hotspots') within the LWP study area where watershed assessment and project implementation should be focused;
- (3) providing periodic review and feedback on technical findings and documents produced during the effort;
- (4) developing recommendations regarding watershed management activities/measures that should be adopted in order to meet the LWP goals; and

(5) initial contact and 'recruitment' of landowners of properties comprising potential watershed project sites.

A local watershed stakeholder is any individual, agency, institution or organization/group that holds a stake in the LWP process and its outcome/products -- i.e., that can influence and/or be affected by the decisions, recommendations or solutions that come out of the process. In general, LWP stakeholders include state and local resource agency professionals, local government (county and municipal) staff, local or regional land or watershed conservation groups, state funding programs for water quality protection/improvement, and interested citizens or landowners. The Indian Creek & Howards Creek local stakeholder team consists primarily of representatives from state and local agencies and local government staff involved in natural resources management within Gaston and Lincoln Counties.

Representatives from the following groups/agencies served on the Indian & Howards Creek LWP stakeholder team:

- Lincoln County Soil & Water Conservation District (SWCD)
- Lincoln County/USDA Natural Resources Conservation Service (NRCS)
- Lincoln Natural Resources Committee (LNRC)
- Gaston County Natural Resources Department
- Gaston County SWCD
- Gaston County Planning & Development
- Carolina Land & Lakes RC&D
- Lincoln County Department of Planning & Inspections
- City of Lincolnton Department of Planning
- City of Cherryville, Water Treatment & Supply
- Catawba Lands Conservancy
- NC DENR Public Water Supply Section Source Water Protection Program
- NC Department of Transportation (NC DOT) Division 12
- NC Rural Water Association (NCRWA)
- NC Division of Water Quality (DWQ) Winston-Salem Regional Office
- NC DWQ Mooresville Regional Office
- NC DWQ Use Restoration Waters (URW) Program
- NC DWO Basinwide Planning Program
- NC DENR Clean Water Management Trust Fund (CWMTF)
- Appalachian State University
- The *Lincoln Times-News*.

The stakeholder team also includes the EEP LWP project team, comprised of EEP watershed planning and project implementation staff and the technical contractors/consultants performing the watershed assessment and monitoring work in the LWP study area (Entrix, Inc. and DWQ's Watershed Assessment Team, or WAT). Organizations/agencies that were also invited to participate (and who regularly received stakeholder meeting summaries and related emails) included NCSU Cooperative Extension Service, NC Wildlife Resources Commission, Catawba County Department of Planning, and Centralina Council of Governments (COG).

Stakeholder Meetings

From March 2008 through April 2010, a total of nine stakeholder meetings were held for the Indian & Howards Creek LWP initiative. All meetings were held at the Lincoln County Senior Center, located at the Lincolnton campus of Gaston Community College. The meetings were facilitated by EEP planning staff. Meeting minutes were recorded by EEP staff, with follow-up meeting summaries and action items distributed within a couple weeks of each meeting.

Meeting presentations (PowerPoint) and detailed meeting notes for each of the stakeholder meetings are located at EEP's project website for the Indian/Howards Creek LWP effort, under the *Meeting Materials* link:

http://www.nceep.net/services/lwps/Indian_Howards_Creek/INDIAN_HOWARD_CREEKS.html.

A summary of each of the stakeholder meetings follows.

<u>Meeting #1: March 18, 2008</u> – This served as the "kick-off" meeting for the Indian & Howards Creek LWP stakeholder team. It included presentations from EEP staff that outlined the overall LWP process, identified major goals of the LWP process (from EEP's perspective) and provided examples of the types of watershed (stream and wetland mitigation) projects that EEP typically pursues. Steve Kroeger of the DWQ-WAT presented an overview of the types of water quality and biological monitoring data to be produced and evaluated by his team during the course of the LWP study. Stakeholders preliminarily identified the major watershed issues they wanted to see addressed by the LWP work and shared information on existing and proposed watershed-related ordinances within the Indian Creek and Howards Creek watersheds.

<u>Meeting #2: June 17, 2008</u> – DWQ-WAT staff provided a summary of existing water quality data (and data gaps) for the LWP study area and an overview of the proposed monitoring plan to be implemented. Additionally, WAT summarized the ongoing wetlands study using the NC Wetlands Assessment Method (NC WAM). EEP planner Mike Herrmann presented an update on the Phase I work, including analysis of 2005 GIS datasets (land cover, aerial photography) to identify high-quality riparian areas, degraded stream buffers and impacted wetlands. Stakeholders began to identify and categorize their local priorities, including watershed threats that are both geographically focused (subwatershed-specific) and watershed-wide. Eight categories of high-priority watershed issues were identified by the stakeholders: threats from stormwater; the need for outreach/education on watershed problems and solutions; drinking water protection; water *quantity* issues; agricultural stressors and BMPs; regulatory/enforcement efforts; erosion/sedimentation and riparian buffers; land conservation & development.

<u>Meeting #3: September 16, 2008</u> – Results of the Phase I work were summarized -- see the following link for the Preliminary Findings Report and related documents: http://www.nceep.net/services/lwps/Indian_Howards_Creek/Report_Links.pdf.

One conclusion from the Phase I analysis is that a greater percentage of subwatersheds in the Howards Creek watershed contain low-functioning streams and wetlands than in the Indian Creek watershed, despite the fact that a six-mile stretch of lower Indian Creek is considered impaired (biological integrity) by NC DWQ and is on the 2006 303(d) list. Three geographically focused stressors may contribute to the impairment of lower Indian Creek: agricultural activities (e.g., dairy farms), the Cherryville WWTP, and NC DOT road construction on Highway 150 that took place in 2006. Jay Frick (NC DENR Public Water Supply Section) requested volunteers to form a subgroup that would focus on development of a Source Water Protection Plan for the city of Cherryville's drinking water supply.

EEP planner Hal Bryson facilitated an effort to translate the major watershed issues identified by the stakeholders at the last meeting into **specific LWP objectives** for addressing the major watershed stressors, grouped into three categories. Nine major stakeholder objectives for the LWP effort were identified:

Urban

- 1 Identify the best subwatersheds and project sites for stormwater BMPs;
- 2 Develop recommendations for improving stormwater management;
- 3 Seek funding for stormwater BMPs identified through the LWP.

Rural

- 1 Work with rural landowners to implement agricultural BMPs within priority subwatersheds;
- 2 Work with Land Trust(s) to develop a rural preservation strategy.

Watershed-Wide

- 1 Identify priority subwatersheds and rank projects for implementation within these subwatersheds;
- 2 Evaluate the effectiveness of current local ordinances related to watershed protection and develop recommendations to (a) establish new ordinances, as needed, and (b) more effectively enforce existing rules/ordinances;
- 3 Develop a local Watershed Education Program;
- 4 Develop a Source Water Protection Plan for the city of Cherryville.

Three subwatersheds in upper Howards Creek (H-3, -6 and -8) and five in lower Indian Creek (I-9, -10, -12, -14 and -16) were tagged by stakeholders as being good candidates for agricultural BMPs. Three subwatersheds within the Indian Creek watershed – two in the Cherryville area (I-12 and -14) and one in middle Indian Creek which includes the West Lincoln High School site (I-7) – were identified as having good opportunities for stormwater BMPs.

<u>Meeting #4: January 27, 2009</u> – This meeting began with a brief discussion of the Phase I subwatershed functional ratings (see above) and the critical questions and data gaps to be addressed by the Phase II (watershed assessment) work being conducted by Entrix and DWQ-WAT staff. DWQ's Susan Gale presented results of the NC WAM wetlands functional assessment conducted during August of 2008 at 29 jurisdictional wetland sites, six of which have been recommended to EEP as opportunities for wetland enhancement projects. DWQ-WAT presented the results of the benthic sampling conducted at fives sites in October of 2008, preliminary results for physical/chemical parameters at 27 sites, and stormflow sampling for fecal coliform.

Hal Bryson asked the stakeholders to rank in priority order four of the nine objectives they had identified at the last meeting; specifically, the four goals/activities that could reasonably be addressed by stakeholder subgroups within the remaining LWP timeline of approximately 12 to 16 months. In rank order, these priority goals were: (1) Stormwater Management Recommendations; (2) Development of a Rural Preservation Strategy; (3) Local Ordinances Review & Recommendations; and (4) Development of a Local Watershed Education Program. As most of the stakeholders expressed a willingness to do so, it was decided at this meeting to establish two additional Subgroups (in addition to the existing one headed up by Jay Frick on Source Water Protection planning). The Subgroups were assigned responsibility for developing recommendations associated with one or more of these four priority goals, to be integrated into the final Watershed Management Plan. The Subgroups typically would meet immediately before or after each of the full stakeholder meetings. The three subgroups (and their membership) follows: Source Water Protection Plan – Jay Frick (NC DENR – PWSS) and Debbie Maner (NCRWA) Stormwater Management & Local Ordinance Review – Hal Bryson and Paul Wiesner (NC EEP); Rick McSwain (Lincoln SWCD); Rob Carson (Lincoln County Planning); Dean Parker (Gaston Natural Resources Dept.); Ron Smith and Patrick Armstrong (Gaston County Planning & Development); and Dan McClure (Carolina Land & Lakes RC&D).

Rural Preservation Strategy – Matt Card (Catawba Land Conservancy) and Mike Herrmann (NC EEP).

<u>Meeting #5: April 23, 2009</u> – Steve Gurley (City of Lincolnton Planning Director) presented an overview of the geology of Lincoln County, emphasizing the connection of rock type, bedrock structures and soils to local watershed characteristics. Representatives from the three Subgroups gave updates on their activities. Jeff Keaton (Entrix) provided an update on their stream and wetland field assessment work, including visits to 40 potential stream restoration sites, 30 potential wetlands restoration sites, 10 preservation opportunities and 10 BMP candidate sites. Jeff also introduced the Multi-Criteria Decision Analysis (MCDA) framework, aka, the Net Environmental & Community Benefits Analysis (NECBA) model, for prioritizing all the projects being considered for the final Project Atlas.

<u>Meeting #6: June 23, 2009</u> – This meeting focused on using Entrix's MCDA/NECBA framework to develop stakeholder criteria for ranking all the local watershed projects (60 field-screened sites) to be included in the final Project Atlas. The sites included 25 stream restoration projects, 10 stream preservation sites, 20 wetland restoration/enhancement sites, four stormwater BMPs and one site containing multiple agricultural BMPs. Doug MacNair (Entrix) summarized the email survey results, in which stakeholders raised two particular concerns: the importance of educating local officials about watershed protection tools; and how project *feasibility* should be defined for the project evaluation/scoring exercise. Four breakout groups were formed to define project criteria and to determine metrics and weights for the project site ranking criteria. Ultimately, five groups of project scoring criteria were developed, each with three-to-five specific criteria and associated metrics. Final criteria groups and weights for project scoring were:

 $Group\ A-Functional\ Benefits\ [20\ \%]-e.g.,\ hydrology\ uplift,\ pollutant\ load\ reduction\ (sediment);$

Group B – Feasibility [26 %] – e.g., technical feasibility, cost, mitigation credits;

Group C – Proximity Benefits [15 %] – e.g., proximity to downstream drinking water intake, other watershed projects, high-quality habitat, etc.;

Group D – Special Designation Areas [23 %] – e.g., upstream of an impaired stream, future land use;

Group E – Education Benefits [15 %] – e.g., outreach to elected officials, schools, farmers.

<u>Meeting #7: September 29, 2009</u> – An update on the status of the Entrix MCDA/NECBA scoring model was presented; remaining steps included the actual scoring and ranking of the 60 candidate sites for mitigation projects and BMPs, and running a sensitivity analysis to determine which criteria most heavily influence the model output (project site scores).

Steve Kroeger (DWQ-WAT) reported that the final *Integrated Water Quality Report* for the Indian & Howards Creek LWP was posted to the EEP project website and available for review. Steve presented a detailed graphical summary of the major results of the WAT monitoring work that took place from April 2008 to March 2009.

A discussion of possible funding sources for recommended watershed projects followed the DWQ-WAT presentation. Paul Clark (DWQ – Use Restoration Waters Program) reviewed the Section 319 grant program, including base and incremental funding options. He emphasized that the restoration of impaired streams is the primary objective of the 319 program. Rick McSwain (Lincoln SWCD) presented an overview of the NC Ag Cost Share Program, NRCS-administered Farm Bill programs such as EQIP, and a relatively new program known as the Community Conservation Assistance Program (CCAP), which is geared primarily towards cost share projects in urban areas (e.g., cisterns). EEP watershed planner Hal Bryson noted that agricultural and stormwater BMPs immediately within or adjacent to EEP project footprints and that are deemed critical to the success of a restoration/enhancement project may be eligible for EEP funding. These include BMPs such as fencing out cattle from riparian buffers and streams and providing alternate watering sources for livestock.

The meeting concluded with Subgroup progress reports.

<u>Meeting #8: January 12, 2010</u> – In preparation for developing the major Phase II product (*Watershed Assessment Report*), Mike Herrmann presented a summary of all the watershed assessment work and results to date. He highlighted differences in water quality and habitat conditions between the Indian and Howards Creek subwatersheds and identified high-priority sites for habitat conservation. Also at this meeting, results of the Entrix MCDA/NECBA project scoring were presented (see above). Workgroup updates were provided for each of the three stakeholder subgroups noted above – Stormwater & Local Ordinances; Cherryville Source Water Protection; and Rural Preservation. Finally, the stakeholders briefly discussed possible strategies for developing a local watershed education/outreach program. It was recommended that the Lincoln Natural Resources Committee (LNRC) be approached as the lead group for coordinating and implementing local watershed education efforts.

Final results of the MCDA/NECBA project scoring exercise are documented in <u>Entrix Technical Memorandum 5 (TM5)</u>, produced in February 2010.

Final Stakeholder Meeting: April 20th, 2010

Mike Herrmann and Hal Bryson (EEP Watershed Planners) presented a summary of the consensus watershed management recommendations to be included in the final *Watershed Management Plan* (this document). They also provided an overview of the final *Project Atlas*. Debbie Maner (NCRWA) presented a summary of recommendations for the Cherryville Source Water Protection strategy. Paul Wiesner (EEP Project Manager) described the recently initiated Phase IV activities, which include landowner outreach and site-specific project feasibility evaluations for the highest-ranking sites identified within the *Project Atlas*. Paul will work closely with Rick McSwain (Lincoln SWCD) to identify landowners most likely to work with EEP in the Lincoln County portion of the LWP area, i.e., landowners willing to sell or donate permanent easements for stream and wetland mitigation sites. At this point, EEP's mitigation needs are primarily for wetland restoration/enhancement sites; this will be EEP's Phase IV focus over the next several months.

After the final stakeholder meeting (the evening of April 20th), Mike Herrmann presented a summary of the Indian and Howards Creek LWP process and final Plan recommendations to the Lincoln Natural Resources Committee (LNRC). More details on the LNRC are presented in the subsection on Institutional Measures in **Section IV** below.

III. WATERSHED CHARACTERIZATION

The information in this Section is extracted and summarized from the major Phase I and Phase II documents produced for the LWP study area; primarily the *Preliminary Findings Report* (NC EEP, 2009), the *Watershed Assessment Report* (NC EEP, 2010a), and the *Integrated Analysis Report of Water Quality* (NC DWQ, 2010). These document links are available at

 $\underline{http://www.nceep.net/services/lwps/Indian_Howards_Creek/2010/ReportLinks.pdf}.$

Assessment Methodology

The Phase I assessment methods, which focused on a preliminary identification of major watershed assets and stressors, included (1) compilation, review and summary of existing (historical) water quality data by DWQ; (2) development and analysis of GIS data sets by EEP Planning staff; (3) water quality reconnaissance screening (testing key field parameters) by DWQ at selected sites across the study area;

and (4) preliminary input from local stakeholders in identifying restoration/enhancement and protection priorities within the LWP study area.

The Phase II work was built around a detailed assessment of watershed conditions in the field. This work was conducted primarily by staff of Entrix, Inc. and DWQ, and the specific assessment methods included (1) sampling for physical/chemical parameters to assess water quality at representative stream sites within the study area; (2) biological sampling (collection and identification of benthic macro-invertebrates) to assess the ecological health and aquatic habitat conditions at selected sites; (3) measurement and observation of metrics/indicators for riparian buffer conditions, stream bank stability and in-stream habitat at numerous sites across the study area using the DWQ BAU (Biological Assessment Unit) habitat assessment protocol for the Piedmont/Mountains; (4) application of the NC WAM wetlands assessment method at selected sites; (5) measurements of stream bank stability and channel incision at selected sites; and (6) field assessment of candidate sites for stormwater and agricultural BMP sites. The field data collected during these Phase II tasks were compiled, analyzed and interpreted within a functional analysis framework for each of the 34 delineated subwatersheds (see below) in order to determine the major stressors affecting habitat, hydrology and water quality within the LWP study area.

General Watershed Characteristics

As noted in Section I above, the LWP focus area consisted of three 14-digit Hydrologic Units draining a total area of 114 square miles: Indian Creek (03050102050010); Howards Creeks (03050102040040); and middle South Fork Catawba River (03050102040030). Overall land cover statistics for the LWP area are: 49% agriculture, 41% forest, and 10% urban. The LWP study area was divided into 34 subwatersheds [see Figure 3-1], averaging 3.3 square miles each: 10 in the Howards Creek watershed (34 square miles total); 22 in Indian Creek (75 square miles total); and two in Middle South Fork (5.4 square miles total). Urban high-density land cover is concentrated primarily in the Cherryville area (subwatersheds I-12 and I-14) and the western outskirts of Lincolnton (subwatershed I-22). Forestry, agriculture and low-density rural development dominate the balance of the LWP study area. The Howards Creek watershed has a somewhat higher concentration of agricultural land cover (54%) than Indian Creek (46%), but the Indian Creek watershed contains approximately two times the concentration of urban/suburban development (11% versus 5%).

Indian Creek

Land cover within upper Indian Creek (subwatersheds I-1 through I-5) is characterized by significant agriculture and forest, with some areas of low-density suburban land use along rural highways. Middle Indian Creek and its tributaries (subwatersheds I-6 to I-11) drain a similar landscape dominated by agriculture and woodlands, but with a higher percentage of low-density development. Subwatershed I-7 includes a major rural intersection, highway NC-27 and Shoal Road, along which commercial development and West Lincoln High School are located. The subwatersheds comprising the lower Indian Creek drainage (I-12 to I-22) represent the southernmost reaches of the LWP area, including portions of the City of Cherryville (Gaston County). Lower Indian Creek, similar to middle and upper Indian Creek includes a mix of forested and agricultural cover. However, lower Indian Creek also includes the greatest concentration of urban high-density development within the LWP area, and therefore the highest percentages of impervious cover, especially in the vicinity of Cherryville (subwatersheds I-12 and I-14) and Lincolnton (subwatershed I-22).

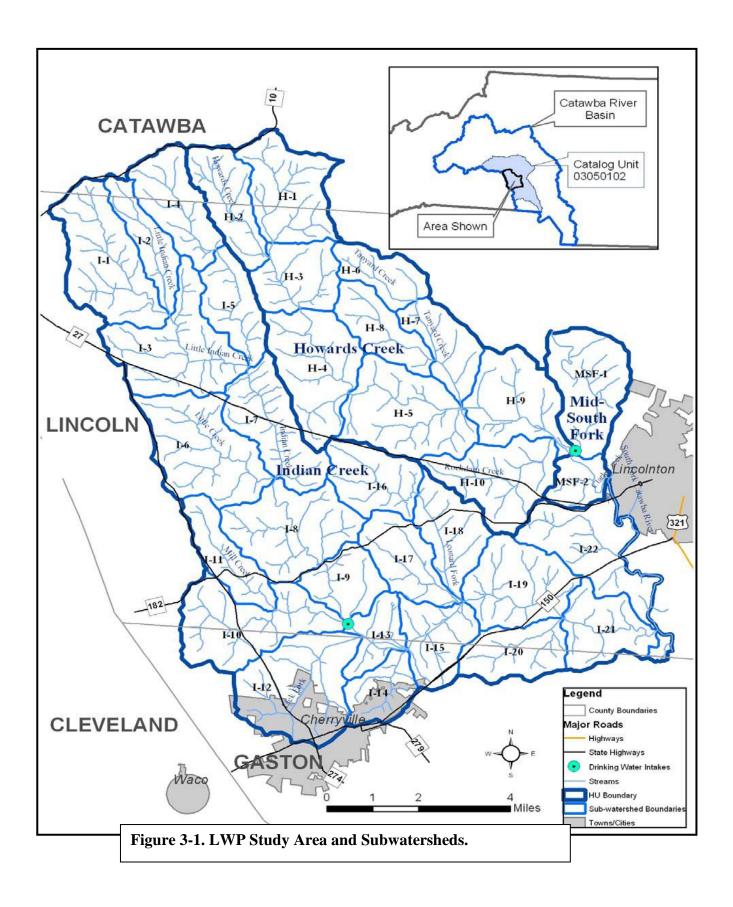
Howards Creek

Upper and middle Howards Creek (subwatersheds H-1 to H-5) is dominated by agriculture and woodlands, with some minor low-density development concentrated along rural roadways. Tanyard Creek and its tributaries (H-6 to H-8) are very similar to upper Howards Creek in their land cover characteristics, although subwatershed H-8 includes a significant concentration of low-density development near the community of Reepsville. Lower Howards Creek (subwatersheds H-9 and H-10) is transected by major highways (Reepsville Rd. and NC-27) northwest of Lincolnton. This area includes the lowest percentage of forest cover within the Howards Creek watershed and significant concentrations of low-density urban/suburban development.

Middle South Fork Catawba River

Subwatersheds MSF-1 and MSF-2, just north and west of the City of Lincolnton, include a mix of agriculture (especially MSF-1) and a significant percentage of low-density suburban development.

A more detailed breakdown of land cover statistics for each subwatershed is presented in Appendix B of the *Watershed Assessment Report* (NC EEP, 2010a).



Subwatershed Prioritization

As noted above in Section II, one of the objectives achieved relatively early by the local stakeholder team (Meeting #3 in September 2008) was the identification of *preliminary* priority subwatersheds. Three subwatersheds in upper Howards Creek (H-3, -6 and -8) and five in lower Indian Creek (I-9, -10, -12, -14 and -16) were tagged by stakeholders as being good candidates for <u>agricultural BMPs</u>. Three subwatersheds within the Indian Creek watershed – two in the Cherryville area (I-12 and -14) and one in middle Indian Creek, which includes the West Lincoln High School site (I-7) – were identified as having good opportunities for <u>stormwater BMPs</u>. This early identification of priority areas (subwatersheds) by the stakeholder team helped guide the Phase II field assessment work conducted by Entrix and DWQ from spring 2008 to spring 2009. This work included the identification of potential stream and wetland restoration/enhancement sites, as well as candidate sites for agricultural and urban BMP sites.

Upon completion of the Project Atlas by Entrix in the spring of 2010 (as part of Phase III), EEP Planners and the LWP stakeholders were able to further refine the identification of priority subwatersheds on the basis of how many top-ranked project sites were clustered (two or more projects) within each of the 34 delineated subwatersheds. On this basis, the final set of priority subwatersheds – in which EEP and local champions/stakeholders should be focusing their implementation efforts – was designated as follows: in the Indian Creek watershed, subwatersheds I-4, I-7, I-10, I-17 and I-21; in the Howards Creek watershed, subwatersheds H-1, H-3, H-7 and H-9; in the Middle South Fork Catawba watershed, subwatershed MSF-1.

Stream Conditions & Major Functional Stressors

The Phase I and II assessment work conducted by NC EEP and its consultants focused on the identification and measurement of stressors affecting three broad watershed functions: hydrology, habitat and water quality. Subwatershed functional indicators were developed from data collected during Phases I and II, and included the following: Mean Stream Habitat Score; Percent Quality Bottomlands (forested buffers and wetlands); EPT Taxa Richness (benthic macroinvertebrates); Percent Impacted Streams (no forested buffer within 50 feet); Stream Channel Incision; Mean Stream Bank Stability Score; Percent Forested Area; Mean Nitrite/Nitrate Concentration; and Fecal Coliform Bacteria Levels. Subwatershed functional ratings were developed for habitat, hydrology, water quality (and overall functional rating).

Habitat

Subwatersheds with the lowest functional ratings for habitat, based on indicators such as stream habitat scores, riparian buffer quality and benthic macroinvertebrates diversity (taxa richness), include those in upper Howards Creek, portions of lower Howards Creek (H-9) and Tanyard Creek (H-8), and Middle South Fork Catawba River. Specific stressors responsible for habitat degradation within these subwatersheds include sediment inputs from unstable stream banks, cleared/drained wetlands, degraded riparian buffer zones (clearing/logging) and direct access of livestock to streams and wetlands. Subwatersheds I-15 and 1-17 in lower Indian Creek also had low habitat functional ratings, reflecting poor riparian buffer conditions and poor in-stream aquatic habitat (e.g., embedded riffles).

Hydrology

Areas within the LWP that rated lowest for hydrologic functions (i.e., that suffer from stream channel incision, unstable stream banks and a lack of forested area) are concentrated primarily in the Middle South Fork Catawba and upper Howards Creek subwatersheds. A tributary subwatershed to Little Indian Creek (I-1), within the upper Indian Creek drainage, also falls into the low-functioning category for hydrology. These areas have been affected by historical channel modification and agricultural activities, wetlands ditching/draining and general land clearing and development.

Water Quality

Water quality impacts -- as measured from key indicators such as dissolved nitrogen concentrations, fecal coliform bacteria levels and riparian buffer conditions -- were most significant in upper and lower Howards Creek and within the Middle South Fork Catawba subwatersheds. Subwatershed I-15 (lower Indian Creek, just downstream of the Cherryville area) also rated low in water quality function. These impacts are due to stressors such as poor agricultural lands management, degraded or missing riparian buffers, and possible fecal coliform sources including livestock in stream channels, degraded/leaking sewer lines or septic fields, and urban/suburban stormwater runoff.

Overall Function

Overall functional ratings developed for subwatersheds in Indian Creek are generally higher than those for Howards Creek subwatersheds – indicating generally higher quality (less degraded) stream and wetland conditions in the Indian Creek watershed. For example, total habitat scores (from the DWQ-BAU protocol) for subwatersheds within Indian Creek averaged 10 points higher than those in Howards Creek. Also, stream bank stability scores were significantly lower for the Howards Creek and Middle South Fork subwatersheds. In terms of water quality indicators, local 'hot spots' (stream sampling sites) with elevated levels of dissolved nitrogen and fecal coliform were documented within both the Indian Creek and Howards Creek watersheds, and are primarily associated with agricultural land use coupled with missing or degraded riparian buffer zones and (in some instances) direct access of livestock to the streams. Despite the fact that Howards Creek subwatersheds have overall lower functional ratings than those in Indian Creek, a six-mile stretch of lower Indian Creek is considered impaired by NC DWQ (due to turbidity and low pH) and is currently on the State's 303(d) list of impaired waters. Major stream stressors within the urbanized subwatersheds in the Cherryville area (middle and lower Indian Creek) and around major highway intersections with secondary development (e.g., NC-27 at Shoal Road near West Lincoln High School) are associated with higher levels of impervious cover, higher stormwater flows and velocities, greater stresses in terms of channel incision and stream bank erosion, and non-point source pollutants associated with urban/suburban runoff (e.g., metals, sediment, oil & grease, fecal coliform).

In addition to the major functional stressors noted above, historical hydrologic modifications in the form of stream channel dredging (sand mining), channel straightening/deepening (to improve drainage for agriculture) and riparian wetlands ditching/draining -- especially in lower reaches of Indian Creek and Howards Creek -- also represent a significant set of watershed stressors within the LWP study area.

For additional details on subwatershed conditions, functional ratings and identified stressors, see the Phase II documents available at the Indian Creek & Howards Creek LWP project website.

IV. PLAN RECOMMENDATIONS

Management Strategies

This section describes the final management recommendations for protection or improvement of hydrology, water quality and habitat within the LWP focus area. The management recommendations include three categories of actions/activities intended to address the major watershed stressors identified within the Indian Creek and Howards Creek watersheds: (1) stream, riparian buffer and wetland mitigation projects (restoration/enhancement and preservation); (2) agricultural and urban stormwater best management practices (BMPs); and (3) institutional measures. The details of site-specific project opportunities that have been identified and prioritized are presented in greater detail within the final *Project Atlas*.

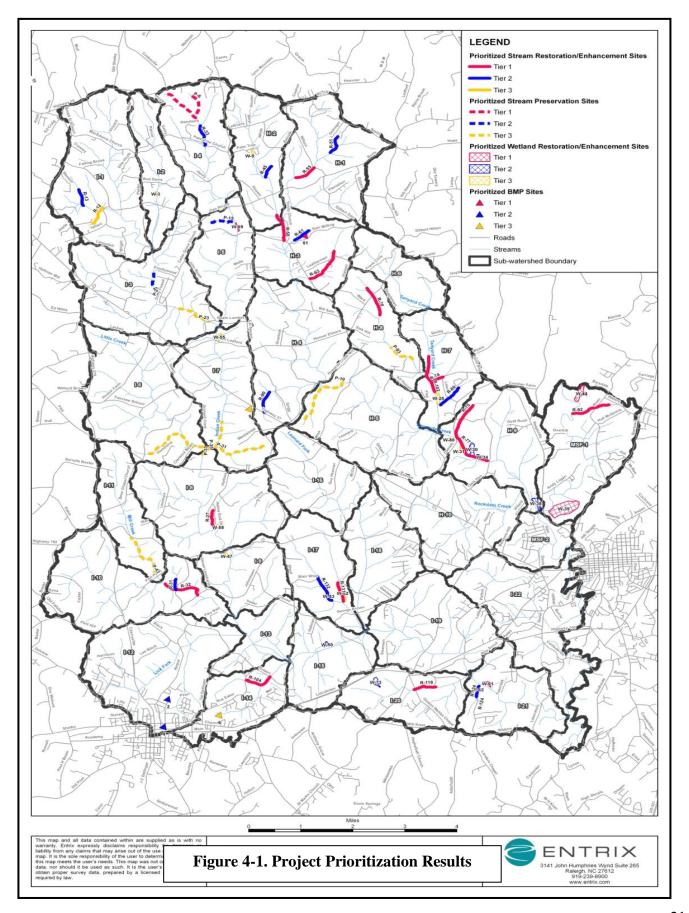
Stream and Wetlands Mitigation Projects

A total of 55 stream and wetland sites were identified as priority projects and included in the final *Project Atlas*. The sites are shown on Figure 4-1 below (Figure 3 from Entrix *Technical Memo 5*), grouped into three priority levels (tiers). [For details regarding the project ranking criteria and weights, see Entrix *Technical Memo 5: Project Prioritization* (February 2010).] These sites include: 25 sites comprising approximately 70,000 feet of stream restoration/enhancement opportunities; 10 sites totaling approximately 51,000 feet of stream preservation; and 20 sites containing 195 acres of wetlands restoration/enhancement potential. Priority sites for stream restoration/enhancement projects are generally concentrated within two subwatersheds draining to lower Indian Creek [I-10, I-17] and within four subwatersheds comprising the upper Howards Creek area and a tributary (Tanyard Creek) to lower Howards Creek [H-1, H-2, H-3 and H-7]. Stream and buffer preservation opportunities are most abundant on tributary streams to upper and middle Indian Creek. The largest and highest-ranking candidate sites for wetland restoration-enhancement projects are within the lower Howards Creek (H-9), middle South Fork Catawba (MSF-1) and lower Indian Creek (I-20 and -21) subwatersheds.

Stream and wetland restoration/enhancement projects would be useful in controlling/reducing some of the key watershed stressors identified during the LWP study, including degraded riparian buffers, incised channels, unstable stream banks, livestock access to stream channels and agricultural runoff (sediment and nutrient impacts).

Stream and riparian buffer preservation projects are critical management tools for the conservation of high-priority aquatic and riparian habitat areas, which occur most extensively within the middle-to-upper reaches of Indian Creek and the middle reaches of Howards Creek. Preservation (through long-term conservation easements) of long stretches of intact riparian buffer areas not only protects the in-stream habitat, floodplain wetlands and wooded corridors of these riparian systems, but also serves to aid in the restoration of downstream reaches and the important hydrologic and water quality functions they provide.

<u>Note</u>: Because the functional improvement (or 'uplift') provided by mitigation projects increases along a continuum from preservation to enhancement to restoration, mitigation credit ratios established by regulatory agencies -- multipliers associated with the length or acreage of stream and wetland mitigation projects -- are higher (more favorable) for restoration/enhancement projects than for preservation projects. For this reason, EEP project managers often pursue restoration/enhancement projects preferentially over preservation projects, but will cooperate with local/regional Land Trusts and other conservation groups to assist in the acquisition of preservation parcels within the LWP area.



Best Management Practices (BMP) Projects

Urban Stormwater BMPs – Urban stormwater BMPs include structures and activities designed to capture or slow down and treat stormwater flowing off impervious surfaces such as roadways, rooftops, parking lots and sidewalks. They are implemented most often in highly developed areas (urban, commercial, industrial, and residential) where such surfaces are concentrated. Such BMPs can be quite effective in removing dissolved and suspended pollutants as well as those attached to sediments from urban stormwater runoff, including suspended solids (TSS), metals, nutrients (nitrogen and phosphorus) and fecal coliform bacteria. Structural stormwater BMPs commonly employed in urban settings include: wet and dry detention basins; constructed wetlands; bioretention areas (rain gardens); sand filters; infiltration basins/trenches; porous/permeable pavement; grassed swales; green roofs; and level spreaders along riparian buffer zones. For more information on the siting, design, construction and maintenance of stormwater BMPs, consult the NC DWQ *Stormwater Best Management Practices Manual* (NC DWQ, 2007).

Four candidate sites for stormwater BMP projects are identified within the LWP *Project Atlas* (Figure 4-2). The Stormwater Subgroup of the Indian Creek & Howards Creek stakeholder team determined that three of these four sites (BMPs-2, -4 and -9) would be feasible to pursue for funding, based on preliminary landowner interest in hosting and maintaining a BMP project (see Figure 4-2). EEP's watershed assessment consultant, Entrix, Inc., conducted pollutant removal estimates using the STEPL spreadsheet model and determined that the proposed BMPs could each achieve sediment reductions of 60 to 70 percent, and nutrient removal efficiencies as high as 40 to 80 percent (Entrix, 2010). [Nutrient and sediment inputs from surrounding land uses/activities have been identified as key watershed stressors within many of the LWP subwatersheds.]

At present, EEP cannot receive mitigation credit for the implementation of stand-alone stormwater BMP projects. Therefore, local stakeholders would have to pursue other funding sources for the design, construction and monitoring of such BMPs. In early 2010, members of the Indian Creek and Howards Creek Stormwater subgroup developed and submitted to the NC DWQ 319 Program a grant application for funding of the stormwater wetland at West Lincoln High School (BMP-9). Figures 4-2 and 4-3 illustrate the proposed BMP site location. The constructed wetland would be located below a ditch at the western edge of a 2.3-acre parking lot. The 319 grant applicants (Carolina Land & Lakes RC&D, in partnership with Lincoln County SWCD and Lincoln County Planning) were notified in the summer of 2010 that their application was approved for funding. The anticipated project start is fall or winter of 2010.

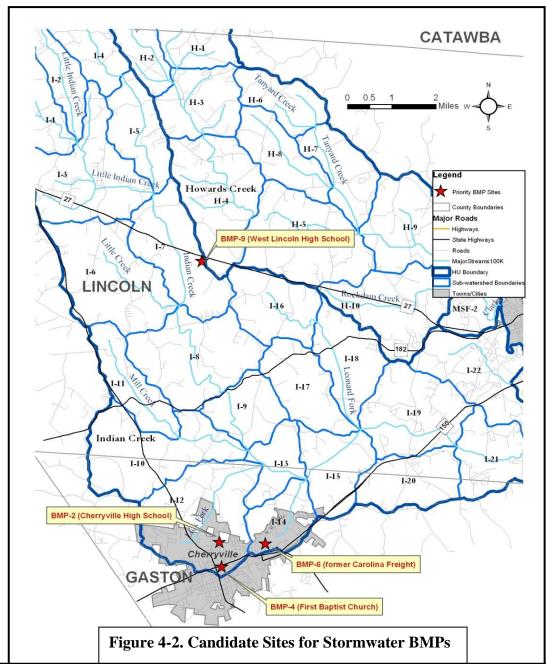




Figure 4-3. Stormwater BMP-9 at W. Lincoln High School

Agricultural BMPs – Agricultural BMPs include structures, procedures and activities designed to control or minimize the environmental impact of certain farming practices. Many agricultural BMPs are designed to reduce or prevent nonpoint source (NPS) pollutants from entering waterways. These BMPs include erosion stabilization (e.g, re-grading and vegetation of gullies), reforestation of erodible crop and pasturelands, streamside buffers/filter zones, no-till planting systems, livestock exclusion fencing, alternate livestock watering sources, nutrient application practices, nutrient management plans, stabilization of animal travel lanes and farm roads, streambank stabilization, stream channel stabilization, animal waste management facilities, stormwater retention ponds and constructed wetlands, agricultural chemical & fertilizer handling facilities, and grass filter strips and swales.

Two agricultural BMP projects were identified at a farm site on a tributary to upper Howards Creek (Site R-61), and are included within the Indian Creek and Howards Creek *Project Atlas*. Predicted pollutant removal efficiencies for these two BMP sites – which include hillslope gully stabilization and animal feedlot management -- range from 22 to 66 percent for sediment and 28 to 82 percent for nutrients (Entrix, 2010). At least two other farms in the Indian Creek watershed were identified as needing special attention to address potential sources of water quality impairment (e.g., livestock access to streams), and staffs of the Lincoln County and Gaston County Soil & Water Conservation Districts are working closely with landowners and farmers at these sites to implement appropriate BMPs (e.g., exclusion fencing and alternate watering sources). Various agricultural funding programs, detailed in Section V of this document, are available to assist farmers in the implementation of BMPs. These programs include the Agricultural Cost-Share Program, Conservation Reserve Program (CRP), Conservation Reservation Enhancement Program (CREP) and Environmental Quality Incentives Program (EQIP). The NC EEP currently has a contract with the NC Division of Soil & Water Conservation, whereby costs for certain agricultural BMPs (including the development of farm management plans) at sites in close proximity to EEP restoration/enhancement projects can be reimbursed. As an element of mitigation project designs at agricultural sites, NC EEP will typically pay directly for BMPs such as livestock fencing, alternate watering structures and stream crossings that contribute to the long-term success of the project.

Institutional Measures

Institutional measures generally include ordinances, codes, regulations and programs implemented by local political jurisdictions (counties and municipalities) to manage growth and development or achieve other objectives related to the protection of local watershed resources. The recommendations presented below include information and proposals developed by the three stakeholder Subgroups discussed in Section III above. In particular, the *Stormwater and Local Ordinances Subgroup* focused on (1) evaluating the adequacy of current ordinances related to watershed management and water quality protection within Lincoln County, which comprises 83 percent of the LWP study area; and (2) developing recommendations for improving current watershed protection measures within the county. The *Source Water Protection Subgroup* focused on developing a Source Water Protection Plan for the City of Cherryville in Gaston County, which involves special recommendations for the middle and upper Indian Creek water supply watershed (WSW) area. And the *Rural Preservation Subgroup* sought to develop a set of recommendations for improved conservation of farmland and ecologically sensitive areas within the LWP area.

Section VII of the Phase I <u>Preliminary Findings Report</u> for the LWP study area (EEP, 2008) describes the *existing* watershed protection rules and policies for Lincoln and Gaston Counties. Ninety-five percent of the LWP study area falls within these two counties. Both Lincoln and Gaston Counties have adopted a variety of measures to help better manage and protect their watersheds. The respective county ordinances which encompass the existing rules/policies can be found at:

Lincoln County – http://www.lincolncounty.org/index.aspx?NID=465
Gaston County – http://www.co.gaston.nc.us/ordinances/watershedord10197.pdf

These existing measures are briefly detailed below at the beginning of the discussion for each of 11 key categories of watershed protection measures. For each of the 11 categories, specific recommendations for improving or expanding existing watershed management rules or policies are also presented. These represent consensus recommendations developed by the stakeholder subgroups mentioned above, and brought before the full group for their approval at the final stakeholder meeting held on April 20th, 2010. Note that there is a varying degree of overlap among many of these 11 categories of recommendations. For instance, watershed education/outreach is a foundational element for many of the watershed management measures. Without some type of watershed education/awareness efforts, it will be difficult to produce local public and political support for many of the recommended measures.

1. Water Supply Watersheds -

The State of North Carolina has designated certain areas within Lincoln and Gaston Counties as water supply watersheds. Figure 4-4 depicts the designated water supply watersheds (WSWs) within the Indian Creek and Howards Creek LWP area. These watersheds drain to water supply intakes for local counties and municipalities.

The regulations encompassed within the WSWs were adopted by the two counties as modeled by the State of North Carolina. The regulations' most stringent task is to limit impervious surface coverage, which contributes greatly to NPS water pollution. For example, upper Indian Creek's WS-II classification restricts residential development to one unit per acre and limits the amount of a parcel that can be built upon. The critical area within one-half mile of the drinking water supply intake is even more stringently protected, including limiting new development to one house per two acres.

By inter-local agreement, Gaston County administers its <u>Watershed Protection Ordinance</u> for the City of Cherryville, the northernmost portions of which drain via Lick Fork and several unnamed tributaries (UTs) to lower Indian Creek *below the drinking water intake*. Only a tiny portion of extreme northwestern Gaston County (approximately one square mile within the Mill Creek subwatershed) falls within the WS-II water supply rules for Indian Creek. Provisions of Gaston County's Watershed Protection Ordinance, as with Lincoln County's, are modeled after the <u>NC DWQ's Model Watershed Protection Ordinance</u>.

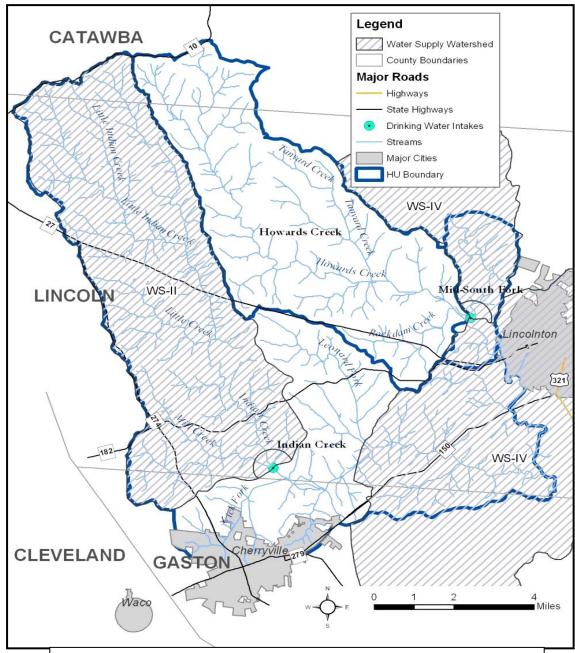


Figure 4-4. Water Supply Watersheds Within the LWP Area

Recommendations

- Continue to work with the development community when plans are submitted for development within these watersheds to encourage alternative development plan design layout and education as to the importance of protecting water quality in drinking water supply watersheds.
- Continue to educate the public, politicians and County/City staff as to the importance of these watersheds, and the unnecessary risks to water quality that an overabundance of impervious surface will create.
- Continue to monitor any changes or updates to the State model water supply watershed regulations to be sure that the County is up-to-date with the most current and progressive regulations.

2. Source Water Protection -

North Carolina's <u>Source Water Protection (SWP) Program</u> is a voluntary program administered by the Public Water Supply Section (PWSS) of NC DENR. The Program's goal is to support local efforts to protect drinking water supplies throughout the state. The NC SWP program offers Public Water Supply systems – such as the City of Cherryville, with a water supply intake located on Indian Creek - an opportunity to learn about a broad range of approaches available to protect their local drinking water supply. The SWP Program also provides information about funding and other resources available to support such local protection efforts. The NC SWP Program is based on the federal programs of the U.S. Environmental Protection Agency (EPA), resulting from the 1996 Amendments to the Safe Drinking Water Act.

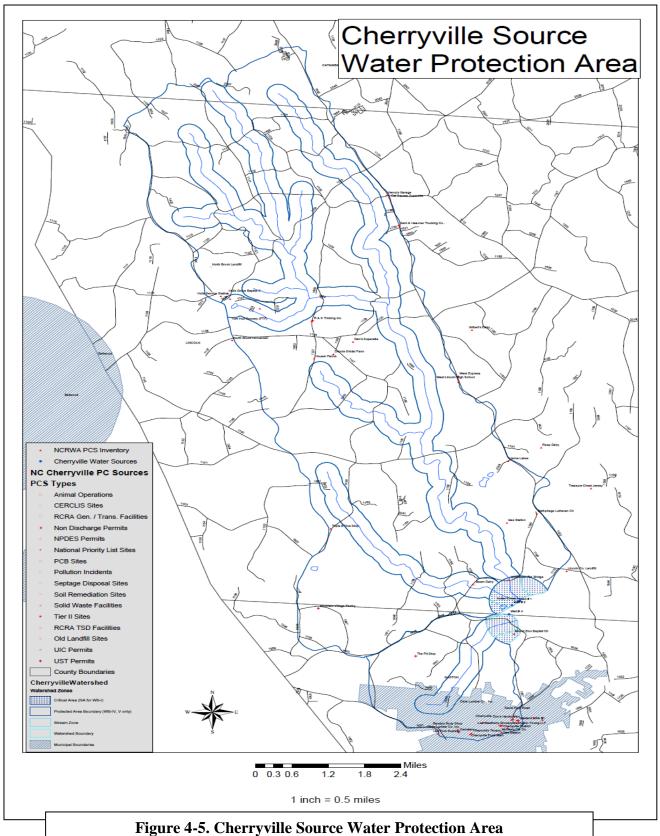
The Source Water Protection program participated with EEP's Local Watershed Planning initiative to develop a Source Water Protection (SWP) Plan for the City of Cherryville. Due to similar processes, an efficiency and synergy was realized in approaching the two goals in tandem. For example, both programs assemble a group of local stakeholders who have the knowledge and ability to create strategies to protect their water resources from possible threats identified during the planning process. This local knowledge-base is an essential element in SWP planning. Additionally, both EEP and the SWP Program use similar data to identify problems and their potential solutions regarding water quality protection.

A SWP subgroup, including SWP Specialist Debbie Maner with the NC Rural Water Association, was formed to take the lead in developing the SWP Plan for Cherryville. The subgroup objectives included:

- identifying and prioritizing possible threats to the city's drinking water source;
- prioritizing projects that the LWP identified on the basis of their contribution to source water protection for the City;
- creating a document for the City to use as a blueprint for the initiation of SWP activities;
- raising awareness of the need for SWP by seeking endorsement of the document (SWP Plan and contained recommendations) by Cherryville's local officials.

This subgroup used a variety of methods and data sources which included: state source water assessment data (e.g., the SWAP report for Cherryville and associated GIS data layers); potential contaminant sources (PCSs) identified in a variety of databases; a windshield survey of the area upstream and surrounding the intake; results of EEP-directed investigations, including stressor data collected by DWQ and Entrix; and EEP's map of priority restoration/enhancement, preservation and BMP projects within the WSW-designated portions of the Indian Creek watershed. A comprehensive list of potential contamination sources to the City of Cherryville's water supply intake (Figure 4-5) was compiled and will be included in the final Source Water Protection Plan.

EEP's watershed assessment and monitoring data collected during this watershed protection planning effort indicate that sediment, nutrients and fecal coliform bacteria are significant water quality stressors within the Indian Creek watershed, including at the Cherryville drinking water intake.



The NC SWP Program has calculated a Susceptibility Rating of "moderate" for Cherryville's drinking water intake on Indian Creek. Susceptibility is an indication of a water supply's potential to become contaminated, given the identified PCSs within the assessment area and physical factors regarding the watershed. The source water assessment program (SWAP) report for Cherryville includes an identification of the multiple water supply sources, pollution susceptibility ratings for each source and an inventory of PCSs such as animal operations, NPDES-permitted discharges, underground storage tanks (USTs) and old landfill sites.

Recommendations

Preliminary SWP recommendations were presented at the final stakeholder meeting on April 20, 2010. Since that time, refinements have been made. The following list includes the most recent recommendations (summer 2010) to the City of Cherryville to begin their voluntary initiatives to protect public drinking water.

- Create an overlay of EEP's priority project sites (from the *Project Atlas*) and determine a subset of these sites that could contribute to the protection of Cherryville's water supply. Since these projects have already been identified and prioritized, some analysis regarding their effectiveness and potential funding may exist. A diverse set of categories is available for examination, including stream restoration sites, wildlife habitat, important forestlands, voluntary conservation, etc. Increased awareness of these project sites and related institutional measures recommended within the final Plan could lead to local political support for funding such projects.
- Land conservation and potential purchase of properties. Consider purchasing property to construct a permanent reservoir. Protective buffers addressing water quality may be eligible to receive low-interest, long-term loans available from the NC DENR. A reservoir could possibly eliminate the water quantity problems associated with the last drought and also with the agricultural withdrawal that occurs on Indian Creek. Purchase and conservation of protective buffers would help ensure a long term, safe supply of drinking water.
- Discourage channeling of stormwater and encourage installation of BMPs to control runoff resulting from development. Support installation of BMPs at sites within the City of Cherryville that have been identified by the Local Watershed Plan. In particular, embrace and assist the momentum associated with a constructed wetlands for runoff associated with West Lincoln High School. As of September 2010, 319 Program funding for this project was imminent. A successful stormwater BMP at West Lincoln High would result in a significant boost to the educational recommendation discussed below.
- Work with NCRWA and NC DENR to develop an educational program which targets diverse groups within the community. Concepts of emphasis include the connection between land use and water quality. Demonstrate pervious surfaces, water gardens, stormwater management BMPs, buffers and other appropriate educational concepts as well as the benefits of conservation. Identify opportunities to introduce SWP concepts into public school activities or similar venues.
- Although the City of Cherryville is located in Gaston County, its drinking water intake and all but a small portion of the Indian Creek water supply watershed (WS-II) is within Lincoln County. Therefore, it is recommended that a direct line of communication be established among the City's Water Treatment Plant (WTP), the Lincoln County Soil and Water Conservation District (SWCD), and the NC Division of Water Quality (DWQ). A method designed for the WTP personnel to alert the state and county agencies when high bacteria levels are detected in samples collected at the water treatment plant may aid in pinpointing the sources contributing to increased biological contamination within the watershed.
- Establish a relationship between the Lincoln County Planning Department and the City of Cherryville regarding land use planning in the western portions of Lincoln County that make up the Indian Creek water supply watershed area. City and Water Treatment Plant officials should become familiar with Lincoln County's Unified Development Ordinance and how it regulates development within the Indian

Creek Watershed and western Lincoln County. They might also consider becoming involved in the politics of the development of future ordinances within the Watershed and educating Lincoln officials about the importance of their intake downstream.

Upon completion of the draft SWP plan, it will be presented to the City of Cherryville Water Treatment Plant Operator and City Manager for their review. Upon their approval, an Executive Summary of the Plan will be presented to the Cherryville City Council and a press release will be generated for the local media. The ultimate goal is to obtain a formal endorsement of the SWP Plan by the Manager and City Council, followed by a commitment to implement the recommendations in the plan. It is important to note that the recommendations provide a starting point for voluntary action. Ensuing discussions with local officials may identify additional or alternate strategies to accomplish proactive source water protection. The Plan will then be submitted to the NC DENR for formal review and state approval. An approved SWP plan can serve as an educational tool and catalyst for improved local water supply protection efforts as well as leverage for funding that can be used to implement specific projects (e.g., stormwater and agricultural BMPs) within the SWP area.

3. Stormwater Management -

Gaston County has developed a stormwater ordinance based on the NC Phase II NPDES stormwater objectives. These rules apply to new developments of one acre or greater and include requirements to control runoff and limit impervious cover. Gaston County's Phase II stormwater program is administered only in those areas of the county not covered by the Watershed Protection Ordinance (see sub-section 1 above, Water Supply Watersheds).

Lincoln County's Unified Development Ordinance (UDO) is seen as sufficiently detailed and authoritative to allow for the adoption of future stormwater rules under NPDES Phase II. The City of Lincolnton will likely fall under these rules after the 2010 population census.

Recommendations

There appears to be a growing consensus that the rapid growth and increasing development pressures in Lincoln County have resulted in the need for a county-wide ordinance that would establish minimum requirements for controlling post-development stormwater runoff (and associated point and non-point source contaminants). Rick McSwain and his staff (Lincoln SWCD), Rob Carson (Lincoln County Planning & Inspections) and others have been involved in the development of a comprehensive stormwater ordinance for Lincoln County. Key elements of the *proposed* ordinance (Draft, November 2009) include the following:

- Redevelopment and new developments that disturb an acre or more of land shall maintain the pre-development hydrologic response (to rainfall) in their post-development state;
- The North Carolina Stormwater BMP Manual shall be used as the basis for decisions about permits, designs, implementation and performance of BMPs;
- Specified permit review fees, application/plan review timelines, site plan elements (e.g., asbuilt plans with design specs) and appeals process;
- Development standards for low-density projects (e.g., use of vegetated conveyances, minimum 50-ft buffer on intermittent and perennial streams, enforceable restrictions on property usage and deeds):
- Development standards for high-density projects (e.g., must control/treat runoff from the first inch of rainfall, 85 % TSS removal, one-year, 24-hour design storm, no encroachment on 100-yr floodplain).

The Draft Ordinance is to be presented to the Lincoln Natural Resources Committee (LNRC) for their review and comment in 2010; then to the County Commissioners; then – after their comments are addressed and necessary revisions are incorporated – a public hearing will be held. The *goal* is to have the final Draft voted upon by Commissioners by early in 2011, with an Ordinance effective date of July 1, 2011.

4. Low Impact Development (LID) -

Lincoln County recently combined and updated local ordinances in a <u>Unified Development Ordinance</u> (effective 8/31/09). This included new language allowing for the use of Low Impact Development (LID) design practices and structures. The primary objectives of LID strategies are to capture (or slow down), infiltrate and treat/filter stormwater runoff as close as possible to its source. By engineering terrain, vegetation and soil features to perform this function, costly stormwater conveyance systems can be avoided, and the site (and broader landscape setting) can retain more of its natural hydrological function. Applied at specific residential or commercial development sites, LID methods can be thought of as small-scale stormwater BMPs designed to retain or approximate pre-development hydrologic conditions, maximizing infiltration and pollutant removal while minimizing the generation of stormwater runoff. When properly designed and implemented, LID can be a very cost-effective alternative to traditional site

development and 'old school' stormwater engineering practices. Specific LID technologies include bioretention areas (aka "rain gardens" – see photo in Figure 4-6), swales, permeable pavers and porous concrete, green roofs, rain barrels and cisterns, level spreaders, sand filters, small-scale stormwater wetlands, vegetated filter strips and riparian buffer restoration/enhancement or preservation.

Recommendations

Rob Carson (Lincoln County Planning & Inspections) has developed a guidance document entitled "Low Impact Design: a summary of modern stormwater controls and feasibility of implementation in Lincoln



County, NC" (2010). The document is intended to be a primer on LID for county commissions and boards, residents, civic groups and developers on the importance and practical implementation of these innovative stormwater control practices.

Specific LID-related recommendations endorsed by Mr. Carson and other LWP stakeholders include:

- Continue monitoring the County UDO as development plans are submitted to help identify possible short-comings in UDO language as it pertains to allowing the use of progressive and innovative stormwater controls;
- Consider providing incentives for the wider use of LID methods in new developments;
- Provide increased public awareness/education for the use of LID and its benefits;
- Continue education/outreach to developers on provisions of the UDO with regard to stormwater management and LID, with emphasis on LID construction methods and benefits;
- Use new tools and software to determine the costs & benefits of innovative stormwater BMPs and LID techniques, such as the <u>CITYgreen software</u>;
- Continue to work closely with developers during the design phases of all development projects;

- Continue research into new stormwater controls and update public education/outreach efforts as more information becomes available;
- Keep all local regulations and the UDO as up-to-date as possible, in order to encourage (or at least remove barriers to) the use of the most beneficial, state-of-the-art stormwater management and LID technologies.

5. Erosion and Sedimentation Control -

Sediment is one of the most common and harmful pollutants to streams and wetlands across North Carolina, and it's been identified as a significant stressor to water quality and aquatic habitat within the LWP area. The Lincoln County Natural Resources Department administers the Soil Erosion and Sediment Control Program within Lincoln County, including such activity within the jurisdiction of the City of Lincolnton. The program operates under the Lincoln Soil & Water Conservation District (SWCD) and the Land Quality Section of the N.C. Department of Environment and Natural Resources, which enforces the requirements of the Sedimentation Pollution Control Act of 1973. Any land disturbance of 1 acre or more requires an approved Soil Erosion and Sedimentation Control Plan; any land-disturbing activity of less than an acre *that requires a building permit* requires an Erosion Control permit. These land-disturbing activities are required to maintain ground cover, protect buffers and conduct periodic monitoring/inspection for sediment runoff.

A similar program operates within Gaston County and is administered by the County Natural Resources Department and the SWCD. However, as of late May, 2010, the future of the county's sediment and erosion control program was in doubt due to local budgetary constraints (Gaston County Natural Resources Department, 2010). The result may be that regional staff of the NC Division of Land Resources, Land Quality Section, will have to step in to provide local monitoring and enforcement of the state's sediment pollution control rules within Gaston County.

Recommendations

- For Lincoln County, strengthen (amend) the existing Soil Erosion and Sedimentation Control Ordinance to address non-residential developments *under one acre in size*, such as commercial redevelopment sites in urban settings, to require an approved Soil Erosion and Sedimentation Control Plan. This would eliminate the existing loophole that allows urban development (or redevelopment) sites that disturb less than an acre to be permitted without a formal erosion control plan created by a professional erosion control specialist. In urban settings, special sediment control measures are needed to address storm drains and inlet structures that are not adequately protected from sediment inputs from silt fencing alone.

6. Riparian Buffers -

The Lincoln County Streamside Buffer Ordinance (adopted 2007) was modeled after the State's Catawba River Buffer regulations, which apply to the main stem of the Catawba River and Catawba River lakes/reservoirs. The County regulations state that a minimum 50-foot buffer be maintained on both sides of all perennial and intermittent streams, measured horizontally landward from the top of each stream bank. This is a two-zone buffer: the first 30 feet adjacent to top of bank is a 'no touch' zone (must be left undisturbed); the outer 20 feet shall be managed vegetation (grass), other ground cover or natural vegetation. No development or impervious surfaces are allowed within either of these two zones.

Gaston County requires a minimum 30-foot vegetative buffer for low-density development along perennial waters on USGS 1:24,000 scale topographic maps; and 100-foot buffers for high-density development.

Recommendations

- Adopt and overlay Lincoln County streamside buffer regulations along the main stem of the Catawba River (including Lake Norman). Lincoln County regulations are more stringent than the current State regulations and this would facilitate enforcement. Currently the State Division of Water Quality (NC DWQ) oversees the main stem of the Catawba River and this can cause some confusion for landowners and State and County Staff. [Note: this recommendation does not apply specifically to the LWP area, but is an important recommendation that Lincoln County stakeholders wanted to include in the Plan.]
- Continue to educate the County citizens about the streamside buffer regulations and the importance of these regulations for water quality. Creation of informational diagrams, pamphlets and posters would facilitate this educational process.
- Continue to monitor the State's model streamside buffer ordinance for updates, and make revisions to the County Ordinance should new findings show increased measures need to be incorporated.

7. Greenway Trails -

In coordination with the Carolina Thread Trail, Lincoln County has written and adopted a <u>Greenway Trails Master Plan</u>. Greenway plans typically seek to provide trail routes along existing riparian corridors, and this is the case with a large majority of the proposed routes in the County's Plan. Within the Indian Creek and Howards Creek LWP area, the Greenways master plan identifies West Lincoln Park, Howards Creek Mill, the Laboratory Historic District and Crouse as "priority destinations". The Reepsville Road Bike Route and Indian Creek River Corridor are proposed as two major segments of the Carolina Thread Trail within the LWP area of western Lincoln County.

Lands acquired through greenway easements, using funds from grant programs such as 319 and CWMTF, would be conserved in perpetuity -- protecting stream banks from erosion, contributing to the removal of pollutants from urban and residential runoff, and creating valuable wildlife habitat within riparian corridors. The use of greenways as linear parks also benefits the health of citizens through expansion of recreation opportunities. Additionally, a network of greenway trails can safely link county residents and tourists with destinations such as businesses, parks and historic sites. Greenways planning and acquisition in both Lincoln and Gaston Counties synchronizes well with requirements of local streamside buffer ordinances, affording an added level of protection for lands within floodplains and riparian corridors -- so long as impervious cover and structures are minimized within the footprint of the greenway.

Recommendations

- Search out grant opportunities to gain the money needed to help construct portions of the County's greenway trail system.
- Educate the public, politicians and developers as to the importance of an interconnected greenway trail system, for the health of citizens, water and wildlife. Include information about the potential tax benefits to property owners who donate or sell conservation easements.
- Work with developers of parcels along proposed and existing trail corridors to provide connections, possibly through the use of Common Open Space.
- Work with developers and builders at sites along the Greenway network to encourage the use of LID practices.

8. Tree Preservation -

Lincoln County staff have drafted a proposed Tree Protection Ordinance that recognizes the importance of preserving existing stands of trees within strategic areas for the purposes of water quality protection, stormwater runoff and erosion control, wildlife habitat, recreation, education and aesthetics. Initial feedback on the first draft will likely cause County staff to scale back the scope and stringency of the proposed tree protection requirements, especially considering that the existing streamside buffer regulations do serve to protect large areas around streams, lakes and wetlands. Education of landowners and developers is critical to the long-term success of these efforts.

Recommendations

- Continue research into effective tree preservation ordinances that don't hinder responsible development and that create development plans in harmony with the surrounding landscape.
- Ideally, *Tree Protection Areas* within the proposed ordinance would be defined to include steep slopes, buffer zones around streams, wetlands and ponds, and high-probability development areas containing existing high-quality tree cover (mature canopy species).
- At a minimum, clearing of land at new development sites should be limited to road rights-of-way (ROWs), utility easement corridors and building locations; with the goal of maintaining -- to the maximum extent practical -- the natural integrity of the site outside of these specific areas.
- Allow/encourage educational activities and passive recreation within designated Tree Protection Areas (e.g., hiking/walking trails, benches, observation platforms and educational signage).
- Continue educating the public, politicians and the development community as to the importance of leaving natural/native vegetation intact (especially deep-rooted species of grasses, shrubs and trees) for the purposes of soil and stream bank stabilization, erosion control, water quality benefits, etc.
- In particular, coordinate with district/regional staff of the Division of Forest Resources and Wildlife Resources Commission to educate landowners, local officials and developers as to the benefits and methods of private woodland management and tree protection.

9. Stream Mapping -

To achieve maximum effectiveness, local regulatory measures such as streamside buffer rules and stormwater control ordinances require detailed maps that accurately depict the locations of all perennial and intermittent streams. The National Hydrologic Dataset (or NHD), based on USGS 1:24K mapping, is the most widely available dataset for stream locations. However, it commonly misses many smaller headwater tributaries and is estimated to be only about 60% accurate in terms of total actual stream footage (perennial and intermittent) within a given drainage area. In fact, during Phase I of the LWP initiative, the NHD stream file was augmented and corrected using aerial photography data, resulting in about 30 miles of stream being added to the hydrography data layer for the LWP watersheds.

A method has been developed by the NC DWQ to provide a more accurate depiction of stream locations, and this methodology is being applied cooperatively within several watersheds across the state. Lincoln County Planning staff, in conjunction with the County Natural Resources Department and GIS staff (and with support of the NC DWQ) has initiated a stream identification and mapping project in the county. The project entails the use of a GIS software model and field surveys to create a highly detailed GIS stream layer. The project is time-consuming and labor-intensive (watercourses within nine focus areas of undeveloped land are scheduled to be walked and GPS-mapped), but the efforts will produce a valuable data set for use by County staff, private developers and citizens. Once finished, the newly created GIS layer will be used to protect previously unidentified riparian buffers and the data placed on the county's GIS website.

Recommendations

- Continue to survey for streams on potential development sites as plans are submitted.
- Educate the public, politicians and developers about the need to locate streams on potential development sites and throughout the County.
- Continue to coordinate with the Division of Water Quality in completing the stream mapping surveys. More hands in the field will complete the project in a timely manner. [Currently, the Lincoln County stream mapping project is estimated to be complete by spring 2012.]

10. Rural Preservation -

Land use within the LWP is predominantly rural in nature, with agriculture and forested lands occupying roughly 49% and 40% of the area, respectively (NC EEP, 2009). These rural lands provide a number of important services and functions, including:

- Drinking water supply services provided by forests, riparian buffers, wetlands and floodplains (e.g., groundwater recharge, water quality protection);
- Habitat for terrestrial and aquatic flora and fauna;
- Recreation and open space;
- Working lands (farming, forestry) of significant economic & cultural value to the region.

The Rural Preservation Subgroup, consisting of representatives of NC EEP and the Catawba Lands Conservancy (CLC), has reviewed a number of existing mechanisms and tools to protect rural lands. These tools should be seen as resources to help protect the services provided by rural lands. Additionally, recommended strategies and actions are presented below to help improve land protection efforts and make them more effective in the face of increasing development pressures.

Threats to Rural Lands

Population growth estimates provided in Table 4-1 help demonstrate rural preservation challenges in the LWP counties, which lie in and adjacent to the Charlotte Metropolitan area. In the LWP counties of Gaston, Lincoln, and Catawba, population growth added an estimated total of 108,000 people between 1990 and 2010, a 31% increase (NC Office of State Budget and Management (OSBM), 2010). Based on projections from NC OSBM (2010), this strong growth is forecast to continue with the LWP counties adding an estimated 85,000 people between 2010 and 2020. Much of this population growth is likely to occur in the eastern portion of these counties, closer to Charlotte and outside the LWP area. Projected growth, however, will likely begin to spillover, changing the largely rural landscape of Indian Creek and Howards Creek watersheds.

Table 4-1. Growth Statistics for LWP Area Counties (Source: NC Office of State Budget and Management, 2010).

				Estimated Population Growth 1990-2010		Estimated Population Growth 2010 -2020	
County	1990	2010	2020	(ppl.)	(%)	(ppl.)	(%)
Gaston	174,769	214,025	258,498	39,256	22%	44,473	21%
Lincoln	50,319	78,543	98,722	28,224	56%	20,179	26%
Catawba	118,412	159,078	179,760	40,666	34%	20,682	13%
Total	343,500	451,646	536,980	108,146	31%	85,334	19%

A study completed by the UNC Charlotte (UNC-C) Renaissance Computing Institute (RENCI) was used to examine how forecast growth in Lincoln and Gaston counties could occur. RENCI researchers used satellite derived land cover data to measure historic growth between 1976 and 2006, and then studied the factors influencing growth (e.g., distance to urban centers, terrain slope, proximity to roads, etc.) to create development probability estimates for undeveloped areas such as forest or agricultural lands (UNC-C RENCI, 2010). Population estimates were then used to forecast land cover change. More information on the land cover change assessment from RENCI can be found online at http://www.renci.org/about/locations/renci-at-unc-charlotte and at http://gis.uncc.edu/URBAN/summary/.

Figure 4-7 and Table 4-2 in this sub-section provide both graphical and tabular illustration of the results of RENCI's development model. Based on the RENCI estimates, development in the LWP area has increased by 7,404 acres between 1996 and 2006. Researchers project that an additional increase of nearly 6,900 acres will be developed from 2006 to 2020. Geographically, most of this development is forecast to occur in either the eastern portion of the LWP area or near existing roads.

Table 4-2. Development Trends in the LWP Area (Source: UNC-C RENCI, 2010).

Watershed	1996 2006 Development Development (ac) (ac)	2020 Development (ac)	1996-2006 Development Increase		2006-2020 Development Increase		
			(ac)	(%)	(ac)	(%)	
Howards Creek	1,692	3,979	5,544	2,287	135%	1,566	39%
Indian Creek	6,344	11,001	15,628	4,657	73%	4,627	42%
Mid-South Fork	416	877	1,563	460	111%	686	78%
LWP Area	8,452	15,856	22,735	7,404	88%	6,879	43%

As a result of increased development, working farms and forest in the LWP area will be lost. The extent to which (and timeframe over which) this conversion occurs, however, will influence the ability of watersheds to sustain their functions of habitat, hydrology, and water quality.

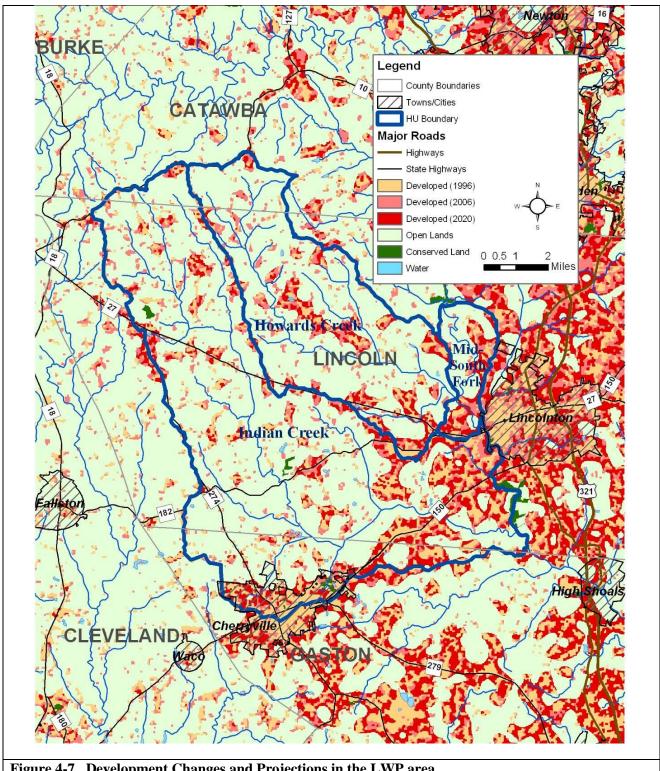


Figure 4-7. Development Changes and Projections in the LWP area (Data Source: UNC-C RENCI, 2010).

<u>Identification of Priority Rural Preservation Areas</u>

Phase II of the LWP has identified priority areas for protection of biodiversity and wildlife habitat (NC EEP, 2010a). In addition to habitat protection, several tools exist to prioritize land protection for other functions. At the state level, the NC Conservation Planning Tool (CPT) offers priority assessments for Water Services, Agriculture, and Forestry. More information about these tools and their associated GIS data can be found online [http://www.onencnaturally.org/pages/ConservationPlanningTool.html.] More locally, the CLC has completed an assessment of parcels in Lincoln County to inform voluntary preservation and conservation efforts (CLC, 2009). These tools offer an opportunity to better focus on lands where voluntary rural preservation efforts should occur.

Figure 4-8 displays the results of several of these different prioritizations. [Sub-figure A is a determination of LWP habitat priorities made by EEP planning staff, building upon the base data within the CPT. Further details on the EEP methodology are found in Appendix A of the Watershed Assessment Report (EEP, 2010a).] Each of these prioritization methods has its merits and is based on differing methods, data and objectives. These conservation planning tools, however, may be useful in helping to direct voluntary conservation and protection efforts. By building off these established assessments, it may be easier to communicate conservation priorities and objectives to potential grant partners at the state and federal level.

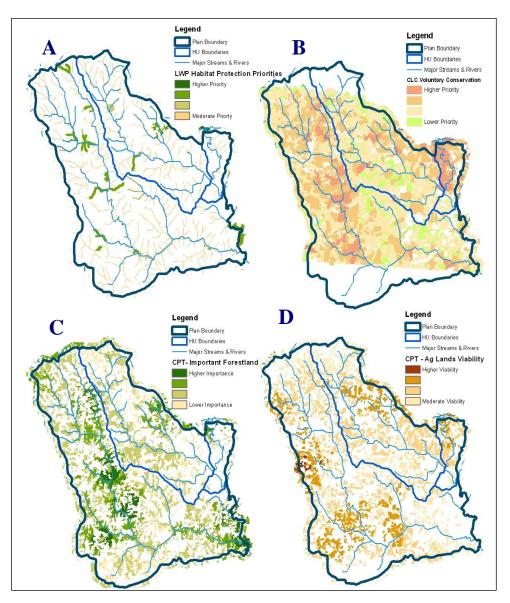


Figure 4-8. Rural Preservation Assessments to Help Identify Important Habitat and Working Lands. **A-** Biodiversity and Wildlife Habitat Assessment Priorities (NC EEP, 2010a). **B-** CLC Priority Voluntary Conservation Assessment for Lincoln County (CLC, 2009). **C-** CPT Important Forestland (NC NHP, 2009). **D-** CPT Agricultural Land Viability Rating (NC NHP, 2009). CPT data can be accessed at http://www.onencnaturally.org/pages/ConservationPlanningTool.html.

Mechanisms for Protecting Rural Lands

Protection of rural land can occur through a variety of mechanisms. Funding sources can be used to permanently protect working farms and forests (e.g., North Carolina Agricultural Development and Farmland Preservation Trust Fund). Funding mechanisms are also available to support protecting and improving habitat (e.g., Partners for Fish and Wildlife, The Natural Heritage Trust Fund). A more complete list of funding sources for watershed protection can be found in Section V of this document. Organizations such as CLC or the local State Soil and Water Conservation District can be partners and provide technical assistance in voluntary land protection efforts.

Funding sources, though, cannot serve as the sole protection mechanism for rural lands. Federal, State, and local laws and ordinances play a pivotal role. For example, federal laws such as the Clean Water Act

provide protections for wetlands and streams. State laws offer additional protections for these resources, including development restrictions in specially designated areas such as Water Supply Watersheds. County and city zoning and land use protections like those previously outlined in the report can be most helpful in protecting important habitat and preserving working farm and forest land. For example, Lincoln County has protections against development in the floodplain that, as a secondary benefit, may protect important habitat such as floodplain forest and wetlands.

Incentives to protect important habitat can also be built into ordinances. Catawba, Lincoln, and Gaston counties have incorporated these incentives into their subdivision regulations in the form of *cluster* development. In Lincoln County's newly approved Unified Development Ordinance, for example, Cluster Residential Development allows development of residential subdivisions to trade conventional lot sizes and dimensions for potentially more, but smaller, lots (Lincoln County, 2009). Using this development option, additional recreation and open space gets protected (e.g., see Figures 4-9 and 4-10). This is most effective when the protected areas are large, contiguous and, where applicable, protects sensitive or high quality habitat (e.g., mature forests, headwater streams, wetlands).

Additional preservation mechanisms include the creation of *Voluntary Agricultural Districts (VADs)* and *Enhanced Voluntary Agricultural Districts*

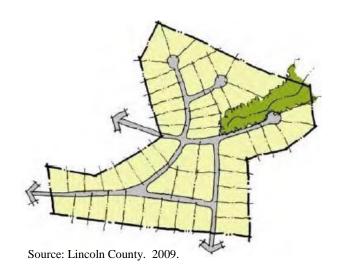


Figure 4-9. Conventional Subdivision Layout.

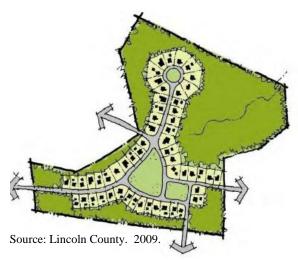


Figure 4-10. Cluster Subdivision Layout.

(EVADs). Eligible lands in these districts receive increased protections for continuing farmland operations, increased public awareness, and, in the case of EVADs, an increase in the percentage of funding under the Agricultural Cost Share Program. EVADs, in return, require a ten-year agreement to

maintain farm operations. VADs and EVADs are therefore effective tools for counties to assist continued farm operations in the rural landscape and have been adopted by Catawba, Lincoln, and Gaston counties.

Recommendations

- **Promote Alternative Development Practices** Growth and development in Gaston, Lincoln, and Catawba counties will continue; therefore, strategies are needed to accommodate this growth while limiting its environmental impact. Forest conservation-based incentives such as cluster subdivisions (a.k.a. conservation subdivisions) should be the encouraged approach for growth in housing because they limit the impact of development on habitat and watershed services such as groundwater recharge. Cluster subdivisions accomplish this by protecting additional lands and allowing for increased housing when compared with conventional subdivisions. Alternatively, restrictive development ordinances should maintain important resource areas (e.g., water supplies, mature hardwood forests, prime agricultural soils). The Center for Watershed Protection offers model ordinances for protecting open space and forest cover online [http://www.stormwatercenter.net/intro_ordinances.htm].
- Develop Farmland Protection Plans Many counties are currently undergoing development of Farmland Protection Plans (FPPs) as a way of recognizing the many contributions made by farmers. These plans also help support their viability by identifying county farming resources, challenges facing farms, and strategies to enable farmers to operate cost-effectively. Gaston County recently completed its FPP with action items that include development of a Purchase of Agricultural Easement Program, adoption of zoning regulations to allow farms flexibility to adapt to market changes, and programs to provide technical assistance on farm protection and conservation options (Gaston County, 2009). Development of FPPs should be encouraged in Catawba and Lincoln counties to help farms sustain their viability. Once developed, these plans will need to be revisited and maintained. [County staff in Lincoln County are committed to conducting further research into FPPs and will be developing a proposed Farmland Protection Plan for consideration by rural citizens and local officials (Lincoln County Department of Planning, 2009).]
- Garner Citizen Support Lincoln County plans to conduct outreach/education related to the development of a Cultural Heritage and Farmland Protection Plan (Lincoln County Planning Department, 2009). The plan would review the historical and cultural heritage of the rural community, emphasizing the importance of agricultural practices and identifying various methods for preserving the 'farming lifestyle'. VADs and EVADs, administered through the Lincoln Soil & Water Conservation District (SWCD), are already in place in the county. Through preliminary outreach to rural residents and county commissioner, County Planning staff have learned the importance of terminology in communicating a vision for rural protection. For instance, "protection" is more palatable than "preservation" to most rural residents, and the *permanent* protection of existing farmlands (through perpetual easements) is potentially problematic, as many residents want to ensure maximum flexibility in terms of future land uses and incomes sources for their children/heirs.
- **Develop Local Conservation Plans** Efforts to protect the environment such as subdivision open space requirements, habitat restoration programs, or conservation projects should be targeted to protect valuable features such as rare species habitat, prime agricultural soils, water supplies, or potential greenway corridors. Identifying these areas through a conservation planning process is a strategic way of protecting important cultural and environmental resources while creating a better informed planning process. Tools like those shown in Figure 2 can be considered to help identify priority protection areas (i.e., where to focus conservation efforts) but local input should be used to refine these tools to make them more reflective of local priorities.
- Coordinate Rural Preservation Efforts A number of funding sources and potential grant partners exist to realize rural preservation goals. To maximize use of these funding sources, coordination is needed among rural protection partners to achieve multiple objectives. For example, efforts to bring the Carolina Thread Trail through the LWP area would benefit from coordination when groups like CLC or NC EEP are

working on voluntary conservation efforts with landowners in the potential trail corridor. Creation of a coordinating group or use of an existing one could be based on models similar to those used in Chatham County (http://chathamconservation.wikispaces.com/), where Federal, State, and local officials are meeting quarterly to exchange ideas, update others on their activities, and coordinate their conservation efforts.

11. Watershed Education -

Education is a key element of the recommendations developed for most of the watershed management categories considered above. Watershed education efforts are fundamental to increasing awareness of local watershed resources and the key functions and services provided by healthy streams, streamside buffer zones and wetlands. With this increased knowledge generally comes an enhanced understanding and appreciation of local watershed resources, and this in turn can lead to changes in behavior by key groups and individuals with the potential to affect the local resources.

Logical steps in developing an effective education/outreach program (or Watershed Education Plan) include

- 1st identifying key objectives of a local watershed education program, and a schedule of milestones for achieving key objectives (including measurable/demonstrable outcomes and benefits);
- 2nd identifying 'target audiences' for the information, e.g., the general public, elected/appointed local officials, developers, schools/students, landowners of priority conservation sites, etc.;
- 3rd determining the most important messages/information to be conveyed as part of the education and outreach efforts;
- 4th identifying or developing the most effective methods and activities for engaging the key target audiences; and
- 5th identifying a group or team of local watershed stakeholders and resource professionals who would be assigned lead responsibility for developing the local Watershed Education Plan and implementing the education/outreach activities.

Watershed education efforts are fundamental to achieving several vital objectives within the LWP area:

- 1 increased regulatory compliance by developers and landowners with key local ordinances (e.g., buffer rules, erosion/sediment control rules) and concomitant reduced need for punitive measures (e.g., fines);
- 2 increased awareness and understanding by local officials (e.g., county commissioners, city councils, town managers) of key local watershed issues and needs in order to build political support for proposed new or amended/strengthened ordinances/measures;
- 3 increased awareness and understanding by homeowners and neighborhood groups of the role they can play in restoring/enhancing and preserving/protecting local watershed resources;
- 4 increased awareness and understanding by farmers and owners of large forested tracts as to the role they can play in restoring, enhancing and preserving priority sites within the watersheds (e.g., through hosting project sites via long-term conservation easements, by applying forestry BMPs);
- 5 increased awareness and understanding by teachers and students of watershed science and the value of streams, riparian buffers and wetlands.

Several of the LWP stakeholders mentioned the Lincoln Natural Resources Committee (LNRC) as a logical existing group to spearhead the development and implementation of a local watershed education/awareness plan. Established by the Lincoln County Board of Commissioners in 2001, the 25-member LNRC is charged with formalizing "recommendations regarding the wise management of our environmental resources as our county faces rapid growth in the coming years". LNRC also sponsors educational presentations on topics related to the wise management of local natural resources [personal

communication, Sylvia Wallace (LNRC Chair), April 2010]. As part of this mission, it seems like a natural fit for the LNRC to guide any new public education and outreach activities related to local watershed protection in the Indian Creek and Howards Creek watersheds -- or at least the majority (83%) of the LWP area comprised by Lincoln County. In a meeting of the LNRC held on April 20th, 2010, members of the LNRC expressed an interest in working with a core group of Indian/Howards Creek local watershed stakeholders to present final Plan recommendations to the County Commissioners and to help develop a local Watershed Education Program for Lincoln County.

Gaston County's counterpart to the LNRC in Lincoln County is the Quality of Natural Resources Committee (QNRC). Members of the QNRC work with the County's Cooperative Extension Service (CES) and staff of the Gaston Natural Resources Department to develop and implement local environmental education programs. In 2009, various <u>curriculum modules related to watershed education</u> and awareness were developed for specific grade levels (e.g., "The Catawba River Basin" for 7th-8th grades). Also, "Erosion Control and Storm Water Education for Adults" focused on provisions in the County ordinance pertaining to preventing water quality impacts from residential and commercial development. Gaston County plans on continuing successful environmental education programs such as these.

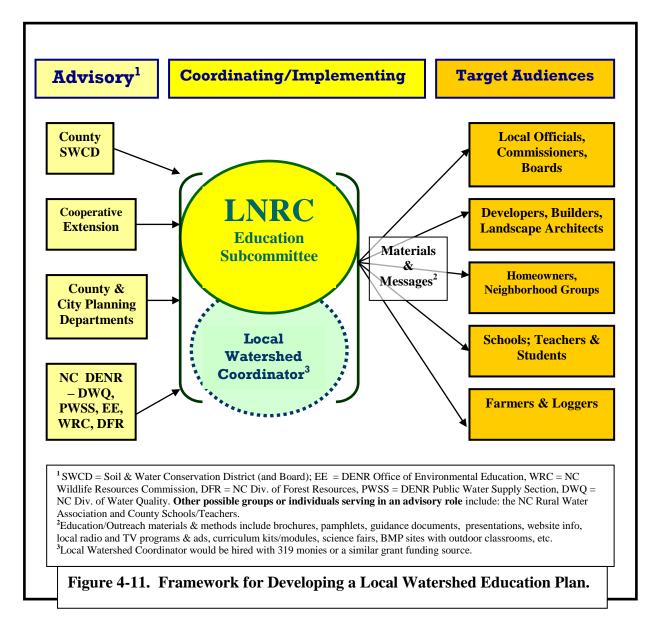
Recommendations

Figure 4-11 presents a recommended framework for the development and implementation of a local Watershed Education Program for the Indian Creek and Howards Creek LWP area. The three major components of a local watershed education program would include: (1) an advisory team or group, consisting of individuals/representatives with specific knowledge or expertise in topics related to watershed management (resource restoration and protection) and environmental education – this could include a core group of interested LWP stakeholders and local resource professionals; (2) a primary coordinating group charged with developing and implementing the details of the watershed education program – in this case, a subcommittee within the LNRC (who could be assisted by a Local Watershed Coordinator, should such a position be funded in the future); and (3) the target audiences for watershed education/outreach activities.

Possible educational materials include a variety of tools and media, including

- brochures (Rob Carson of Lincoln County Planning & Inspections has already developed brochures for stormwater management and LID);
- presentations to elected officials, developers/builders and neighborhood groups;
- radio and television spots;
- science fairs, envirothon and water- or watershed-themed festivals;
- grade level-specific curriculum modules, including water testing kits;
- website information;
- training workshops for builders/developers, neighborhood groups and local government;
- field trips and outdoor classroom demonstrations (e.g., to stormwater BMP sites).

One point of emphasis in 'marketing' watershed education efforts should be the economic cost of degraded watershed conditions (e.g., increased water treatment costs, declining property values) as compared to the economic, human health, wildlife and recreation/tourism benefits of watershed improvement and protection efforts.



V. WATERSHED PLAN IMPLEMENTATION

There are three key elements required for effective implementation of the Indian Creek and Howards Creek Watershed Management Plan: (1) an EEP project implementation strategy; (2) formal adoption of the final Plan by local authorities (e.g., County Commissioners); and (3) development of a coordinated implementation strategy spearheaded by local stakeholders, coupled with an effective local watershed education/awareness program.

EEP Project Implementation

EEP staff will begin pursuing what are known as "Phase IV" activities for traditional stream and wetlands restoration/enhancement and preservation projects identified within the Project Atlas for mitigation credit. This involves working with local resource professionals (typically, SWCD staff) to identify and evaluate those project sites in the final Atlas that are most likely to have landowners interested in participating with EEP via voluntary conservation easement agreements. Starting in the summer of 2010, EEP Project Management staff began working with the Lincoln County SWCD (Rick McSwain and staff) to conduct landowner outreach at such sites. This effort will continue indefinitely as EEP's programmatic mitigation needs within the lower Catawba basin are updated over time.

Adoption of the Watershed Management Plan -

This document – the Indian Creek and Howards Creek *Watershed Management Plan* – is based upon a relatively comprehensive assessment of the hydrology, water quality and habitat conditions within the LWP study area (Section III), as well as an intensive stakeholder involvement process (Section II) that spanned a 2-year period. Recommendations contained within the Plan have been developed to help meet the overall goal of restoring (improving) and protecting (preserving) local watershed resources and functions. The institutional recommendations contained herein are considered to be complementary enhancements to the existing land use plans and watershed-related ordinances of each of the political jurisdictions within the LWP area.

A primary recommendation of the Indian and Howards Creek LWP stakeholder team is to have county commissioners formally adopt this *Watershed Management Plan*. Many of the specific recommendations discussed above could be adopted as new provisions of local development rules or incorporated as amendments into existing sections of local watershed protection ordinances. **At a minimum, county commissioners are encouraged to formally** *endorse* **the Plan** as part of the overall goal of improved protection and management of local watershed resources. This could be accomplished by simply referencing the Plan (and recognizing its goals and recommendations) in county UDOs and/or Land Use Plans. Ultimately, the protection or restoration of local streams, streamside buffers and wetlands can be considered a quality-of-life issue for county residents, as well as a health and economic issue, especially for water supply watersheds.

Coordinated Management Strategy

The establishment of a Local Watershed Council or Advisory Team focusing on Indian Creek and Howards Creek -- perhaps as a subgroup of the Lincoln Natural Resources Committee (LNRC) – is highly recommended. This watershed council or advisory team could serve as a local body for (a) coordinating and tracking the implementation of the various watershed management recommendations contained in this Plan; and (b) hearing and responding to local concerns/complaints about water quality and related issues. As recommended above, the Advisory Team could work with the LNRC to develop and implement a watershed education and stewardship program to support increased public understanding and support of the various recommendations contained within the Plan. In fact, the LNRC could be the lynch-pin group that takes the lead role in advocating for adoption of the Plan recommendations (e.g, a county-wide stormwater ordinance) by the Lincoln County Commission.

The council could function as the lead agency and primary point-of-contact for coordinating and harnessing the efforts of local 'watershed champions', including interested citizens and resource agency staff called upon to address water quality and related concerns brought to their attention. The council would also coordinate local efforts to seek funding from the 319 Program, CWMTF, USDA and other watershed funding initiatives to implement specific recommendations in this Plan, e.g., stormwater and agricultural BMP projects.

Establishing a local watershed council could help ensure that the momentum associated with the EEP-directed Local Watershed Planning initiative would not be lost moving forward from completion of the Plan. **Critical to the long-term success of such a group would be the hiring of a Local Watershed Coordinator**, as has been achieved with 319 funding in other high-priority watersheds within North Carolina. [Note: the NC DWQ's 319 Program prioritizes grant proposals for efforts that will build upon existing Local Watershed Planning initiatives such as this one.] Although these are typically established as time-limited positions administered through County SWCDs, the funding can be renewed via additional grant proposals, especially if local watershed success stories can be realized within two or three years.

VI. TECHNICAL RESOURCES AND FUNDING SOURCES

Websites

The tables below represent an up-to-date compilation of programs, funding sources, and websites available to aid in the implementation of watershed enhancement, restoration, and protection activities within the LWP study area. A list of agency and program acronyms is included at the end of the tables.

Please note that the Indian & Howards Creek LWP project-specific website established by EEP (including all documents, presentations, and meeting minutes from the two-year planning process) can be found at

http://www.nceep.net/services/lwps/Indian Howards Creek/INDIAN HOWARD CREEKS.html.

Table 6-1. Local Watershed Resources

Resource/Group	Description	Website / Contact Info
Lincoln County Division of Soil and Water Conservation (DSWC)	Administers DSWC funding programs (e.g., ag-cost share) in Lincoln county and works to promote conservation of natural resources.	http://www.lincolncounty.org/Directory.aspx?DID=26
Lincoln County Natural Resources Department	Administers the Soil Erosion and Sediment Control Program within Lincoln County.	http://www.lincolncounty.org/index.aspx?nid=695
Gaston County Natural Resources	Administers the Soil Erosion and Sediment Control program within Gaston County along with DSWC funding programs (e.g., ag-cost share).	http://www.co.gaston.nc.us/NaturalResources/index.htm
Catawba County DSWC	Administers the Soil Erosion and Sediment Control program within Gaston County along with DSWC funding programs (e.g., ag-cost share).	http://www.catawbacountync.gov/depts/soilwater/default.asp
City of Lincolnton Planning	Responsible for short and long range City planning, administering development ordinances, code enforcement, community development, and coordination of development activities with other City departments.	http://www.ci.lincolnton.nc.us/planning.html
Surface Water Protection / DWQ Mooresville Office, NC DENR	Administers State laws related to stream and wetland protection.	http://portal.ncdenr.org/web/wq/home/ro/mro
Catawba Lands Conservancy	Nonprofit land trust that permanently protects land, water and wildlife habitat.	http://www.catawbalands.org/
Carolina Thread Trail	The Carolina Thread Trail is a regional trail network that will eventually reach 15 counties and link cities, towns, and attractions.	http://www.carolinathreadtrail.org/
Catawba Riverkeeper	Technical resources, handbooks, GIS data and other information to support conservation minded development.	http://www.catawbariverkeeper.org/

Table 6-2. General Watershed Funding Resources

Description	Website / Contact Info
Provides watershed planning and implementation of	http://www.nceep.net/
,	http://www.cwmtf.net/
	http://www.ewintr.net/
Funding grants for efforts to reduce non-point source	http://portal.ncdenr.org/web/wq/ps/nps/319program
(NPS) pollution including demonstration BMPs,	
education and outreach, and establishing Total	
	http://h2o.enr.state.nc.us/pb/205jPlanningGrantHomePage.htm
	http://www.zsr.org/
	ittp://www.zsi.org
	http://portal.ncdenr.org/web/wq/cgls/iup
and non-point source programs.	
	http://water.usgs.gov/coop/
	http://www.ncwater.org/Financial Assistance/
	http://www.ncwater.org/Financial Assistance/
and dequisition, and addate weed control.	
Provides technical expertise in management of water	http://www.saw.usace.army.mil/Floodplain/Section%2022.htm
and land resources to help States deal with water	
resource problems including floodplain management,	
watershed restoration, and water supply assessment.	
	http://www.fws.gov/raleigh/pfw.html
	http://www.epa.gov/owow/funding.html
	nttp://www.opt.gov/owow/funding.ntmi
	compensatory mitigation projects (e.g., stream and wetland restoration). Offers grants to local governments, state agencies, and conservation non-profits to help finance projects that specifically address water pollution problems. Funding grants for efforts to reduce non-point source (NPS) pollution including demonstration BMPs, education and outreach, and establishing Total Maximum Daily Load (TMDL). Funding available to regional Councils of Government (COGs) for water quality management planning efforts. Private Foundation providing grants dedicated to clean water, clean air, and environmental justice. Funds grants to assist in improvements to wastewater treatment facilities and projects benefitting estuary and non-point source programs. Provides cost-share funds to support water resource information gathering to wisely manage the Nation's water resources. Provides cost-share funding and technical assistance to local governments in subject areas including navigation, water management, stream restoration, land acquisition, and aquatic weed control. Provides technical expertise in management of water and land resources to help States deal with water resource problems including floodplain management,

Table 6-3. Agricultural Watershed Resources

Resource/Group	Description	Website / Contact Info
Agriculture Cost Share Program/ DSWC, NC DENR	Provides cost-share funding to protect water quality by installing BMPs on agricultural lands.	http://www.enr.state.nc.us/dswc/pages/agcostshareprogram.html
Conservation Reserve Program / USDA	Convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover.	http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp
Conservation Reserve Enhancement Program/ Division of Soil and Water Conservation (DSWC), NC DENR	Funds long-term protection of environmentally sensitive agricultural lands through implementation of grassed filter strips, forested riparian buffers, tree planting and wetlands restoration.	http://www.enr.state.nc.us/dswc/pages/crep.html
Environmental Quality Incentives Program/ NRCS, USDA	Technical and financial assistance to implement conservation practices on eligible agricultural land.	http://www.nrcs.usda.gov/programs/eqip/
Wildlife Habitat Incentive Program, NRCS, USDA.	Cost-share funding to promote the restoration of declining or important wildlife habitat.	http://www.nrcs.usda.gov/programs/whip/
Farm and Ranch Land Protection Program/ NRCS, USDA	Offers matching funds to help purchase development rights to keep productive farm and ranchland in agricultural uses.	http://www.nrcs.usda.gov/programs/frpp/
NC Agricultural Development and Farmland Preservation Trust Fund	Funds to support the farming, forestry, and horticulture industries through purchase of agricultural conservation easements and development of agricultural enterprise programs.	http://www.ncadfp.org/index.htm
Other USDA Programs	Offers information on a number a different USDA grants and technical assistance programs including those mentioned here.	http://www.nrcs.usda.gov/programs/
Virginia Soil & Water Conservation – NPS BMPs	Useful summary of information on NPS pollution and best management practices (BMPs) for controlling NPS pollutants including urban, agricultural and forestry BMPs.	http://www.dcr.virginia.gov/soil and water/npsbmp.shtml

Table 6-4. Urban Watershed Resources

Technical resources, handbooks, GIS data and other	1.44//
nformation to support conservation minded development.	http://www.ncwildlife.org/GreenGrowth/
Provides financial and technical assistance to mprove water quality through the installation BMPs on urban, suburban and rural lands, not directly nvolved in agricultural production.	http://www.enr.state.nc.us/DSWC/pages/ccap_program.html
Non-profit foundation providing a wealth of technical resources (e.g., reports, model ordinances, and craining materials) to support healthy land and water management.	http://www.cwp.org/
Their mission is to "learn and teach" stormwater management, including bioretention areas, green roofs, stormwater wetlands, permeable pavements, water harvesting systems, LID and other innovative	http://www.bae.ncsu.edu/stormwater/
nde Principal Pr	formation to support conservation minded evelopment. Tovides financial and technical assistance to approve water quality through the installation BMPs in urban, suburban and rural lands, not directly volved in agricultural production. Ton-profit foundation providing a wealth of technical esources (e.g., reports, model ordinances, and aining materials) to support healthy land and ater management. Their mission is to "learn and teach" stormwater anagement, including bioretention areas, green toofs, stormwater wetlands, permeable pavements,

Table 6-5. Other Watershed Resources

Resource/Group	Description	Website / Contact Info
Use Restoration Watershed Funding Resources/ DWQ NC DENR	Provides technical assistance to restore the beneficial uses of impaired waters.	http://portal.ncdenr.org/web/wq/ps/bpu/urw/funding
Environmental Finance Center Network	A university-based organization at UNC-Chapel Hill along with other universities nationwide that is dedicated to creating innovative financing solutions for environmental protection. The Network includes public and private sector watershed resources.	http://efc.boisestate.edu/watershed/index.asp
NC Cooperative Extension	Provides technical resources, education, and outreach on forestry and environmental management.	http://www.ces.ncsu.edu/
NC DENR Office of Environmental Education	Serves as North Carolina's clearinghouse (central source) for all of the environmental education resources in the state. The office serves PreK-12 schools, colleges and universities, government agencies, non-profit organizations, EE centers, citizen groups, business and industry, libraries and the general public.	http://www.eenorthcarolina.org/
NC DENR - Public	The Source Water Protection (SWP) Program provides	http://swap.deh.enr.state.nc.us/swap/pages/swplinks.htm

Water Supply Section -	guidance and funding opportunities related to source	
SWP Program	water assessment and pollution prevention for public	
	water supplies.	
NC Natural Heritage	Funds the protection of land with outstanding natural	http://www.ncnhtf.org/
Trust Fund	or cultural heritage values.	
N.C. Parks and	Provides matching grants to local governments for	http://www.ncparks.gov/About/grants/partf_main.php
Recreation Trust Fund,	parks and recreational projects to serve the public.	
NC DENR		
NC State University	A multidisciplinary team that analyzes and evaluates	http://www.bae.ncsu.edu/programs/extension/wqg/
Water Quality Group	nonpoint source (NPS) pollution control technologies	
_ , .	and water quality programs in North Carolina.	
EPA Watersheds	Portal to resources on watershed planning,	http://www.epa.gov/owow/watershed/
	assessment, TMDLs, and water quality information.	

Acronyms for Agencies and Programs

DSWC – Division of Soil and Water Conservation

DWQ – Division of Water Quality

EPA – United States Environmental Protection Agency

NC DENR – North Carolina Department of Environment and Natural Resources

NRCS - Natural Resources Conservation Service

USDA – United States Department of Agriculture

USFWS – United States Fish and Wildlife Service

USGS – United States Geological Survey

NPS – Nonpoint Sources

Publications

In addition to the websites listed above, several publications may be useful for providing additional details and recommendations related to institutional measures for watershed protection, including LID and 'smart growth' (or 'green growth') practices. These publications include:

- Center for Watershed Protection, 1998. <u>Better Site Design: A handbook for changing development rules in your community</u>. Center for Watershed Protection, Ellicott City Maryland. August 1998.
- NC EEP, 2006. <u>Lower Creek Watershed Management Plan</u> (Catawba River Basin, Caldwell and Burke Counties). July 2006.
- NC Wildlife Resources Commission, 2009. <u>Green Growth Toolbox</u> (Nature-friendly planning). NC WRC, Wildlife Diversity Program. January 2009.
- N.C. State University, 2009. <u>Low Impact Development: a guidebook for North Carolina</u>. NCSU NC Cooperative Extension Service. June 2009.
- US EPA, 2009. Managing Wet Weather and Green Infrastructure. Municipal Handbook. Water Quality Scorecard. EPA-833-B-09-004. August 2009.

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- NCEEP, 2010b. Indian Creek and Howards Creek Project Implementation Report & Project Atlas. March, 2010.
- NC NHP, 2009. One NC Naturally Conservation Planning Tool. Online at http://www.onencnaturally.org/pages/ConservationPlanningTool.html. Accessed November 4, 2009.
- NC Office of State Budget and Management. 2010. Population Estimates and Projections. Online at http://www.osbm.state.nc.us/ncosbm/facts_and_figures/socioeconomic_data/population_estimates.shtm. Accessed April 8, 2010.
- UNC-Charlotte RENCI, 2010. Forecasting Urbanization in the Greater Charlotte Region. Accessed April 2010.

APPENDIX A

Glossary of Technical Terms

- Aquatic Habitat the wetlands, streams, lakes, ponds, estuaries, and streamside (riparian) environments where aquatic organisms (e.g., fish, benthic macroinvertebrates) live and reproduce; includes the water, soils, vegetation, and other physical substrate (rocks, sediment) upon and within which the organisms occur; also includes microhabitats such as undercut stream banks and woody debris found within healthy streams and wetlands
- **Basin** the largest watershed management unit for planning, consisting of a group of subbasins; typically range in size from 500 to 10,000 square miles; there are 17 major river basins in NC, the largest being the Cape Fear and the Yadkin-Pee Dee, and the smallest the Savannah and the Watauga
- **Benthic macroinvertebrates** organisms living in or on the bottom substrate of aquatic habitats; include insect larvae, worms, snails, crayfish and mussels; can be used as indicators of stream water quality and stream habitat condition
- **BMPs** (best management practices) any land or stormwater management practice or structure used to mitigate flooding, reduce erosion & sedimentation, or otherwise control water pollution from runoff; includes urban stormwater management BMPs and agriculture/forestry BMPs
- **Buffer** an area adjacent to a stream, wetland, or shoreline where development activities (e.g., buildings, logging) are typically restricted or prohibited; may be managed as streamside (riparian) zones where undisturbed vegetation and soils act as filters of pollutants in stormwater runoff. Buffer zone widths vary depending on state and local rules, but are typically a minimum of 25 to 50 feet on each side of perennial streams. In NC, buffer rules have been established for all, or portions of, the upper Cape Fear, lower Catawba, Neuse and Tar-Pamlico river basins.
- Cataloging Unit (CU) U.S. Geological Survey-designated 8-digit Hydrologic Units, typically comprised of multiple smaller 14-digit HUs; total area of CUs ranges from about 300 to 2,000 square miles. There are 54 individual CUs in NC; they can be considered regional subbasins within the larger river basins. They represent the watershed unit within which permitted impacts to waters & wetlands, and compensatory mitigation credits, are accounted for.
- Conservation Easement a voluntary legal agreement between a landowner and a conservation organization (e.g., Land Trust) or public agency (e.g., NC EEP) that limits some portion of the land's uses; conservation easements are intended to preserve certain parcels/tracts in an undeveloped condition so as to provide a local or regional environmental benefit, such as water quality and habitat protection; landowners voluntarily agree to give up certain development rights on the land area in question while still retaining ownership of the land; certain tax benefits may accrue to landowners who sign conservation easements with qualified conservation organizations/agencies
- Compensatory Mitigation any mitigation action taken to compensate for stream and/or wetland impacts associated with a 401/404-permitted project; includes Restoration, Enhancement, Creation and Preservation, with varying degrees of mitigation credit granted by the U.S. Army Corps of Engineers (USACE) and the NC DWQ. [See the latest Stream Mitigation Guidelines (USACE et al, 2003) for further details regarding mitigation credit and mitigation ratios.] Compensatory mitigation is the basic regulatory tool by which "unavoidable" impacts to streams, riparian buffers and wetlands are intended to be minimized (or compensated for) in order to meet the nationwide goal of "no net loss" of wetlands
- Cluster (or Open Space) Development the use of designs which incorporate open space into a development site; in cluster patterns, the layout of buildings, roads, etc. is arranged on a compact portion of the site so as to reserve areas of common open space or greenways; these areas can be used for recreation and/or preserved as naturally vegetated land
- Enhancement wetlands enhancement refers to actions taken to increase or enhance wetland functions through the manipulation of either vegetation or hydrology, but not both; an example would be the filling in of ditches in a previously drained wetland area. This type of compensatory mitigation does not receive as much credit as does Restoration.
- **Fecal Coliform** type of bacteria used as indicator of contamination by human or animal waste (and possible disease-causing pathogens)
- **Floodplain** area of land on each side of a stream channel that is inundated periodically by flood waters; important zone for dissipating the energy of peak storm flow discharges and for storing waters that otherwise

- might damage in-stream habitat and/or cause downstream flood damage; typically includes high-quality riparian habitat (if undisturbed). Waters flowing in incised (down-cut) streams may not be able to access the adjacent floodplain area to dissipate the volume and energy of higher storm flow events
- Functions; Functional Assessment the major functional and ecological components of a watershed (and the focus of restoration, enhancement and protection efforts by the NC EEP) include streams, streamside (riparian) buffer zones, and wetlands. The important landscape functions served by these watershed components, when they are not degraded, include: water quality protection (pollutant removal); fish & wildlife habitat; floodwater storage; and direct human value (e.g., timber production, recreation, education). Functional assessment refers to the process whereby the status of important watershed functions is determined, including an evaluation of historical, current, and projected future impacts to (or losses of) specific functions
- GIS geographic information system consisting of computer hardware, software and data designed for capturing, storing, updating, manipulating, analyzing and displaying all forms of geographically reference information; in EEP, desktop GIS is an important tool used in the assessment of various sets of watershed-related information (specific themes or coverages, e.g., land cover, property parcels, roads, municipal boundaries, streams, designated natural heritage areas, wetlands, soils, etc.) used in identifying the best locations for watershed project sites and management strategies
- Greenways areas of open space with trails, accesses (and possibly recreational facilities) typically sited along riparian corridors; can be linked to form a network of trails for biking, hiking, walking, jogging, etc. in urban/suburban areas
- **Habitat Degradation** physical destruction or deterioration of in-stream and streamside aquatic habitat due to erosion & sedimentation, pollutant inputs, unstable stream banks, channel scour due to excessive storm flows, breaks in the riparian buffer zone, lack of woody debris in/along streams, loss of pools & riffles, etc.
- **Hydrologic Unit (HU)** refers to the 14-digit Hydrologic Unit Codes used by the Natural Resources Conservation Service (NRCS) to identify local watersheds typically ranging from 10 to 100 square miles in total drainage area; used by NC EEP as synonymous with "local watershed"
- Impairment used by NC DWQ to describe any impairment of the use support classification of a given stream; basically, impairment indicates a stream (or stream reach) with decreased water quality to the degree that it is "not supporting" its designated uses (e.g., aquatic life, swimming, fishing, water supply, secondary recreation) because of point source or nonpoint source pollution and/or aquatic habitat degradation
- Impervious Cover a human-created or –modified surface (e.g., concrete, asphalt) that does not allow water to percolate (or infiltrate) through it; examples include parking lots, rooftops, roadways, driveways, sidewalks, compacted soils. Urbanization and development are typically associated with significant increases in the impervious cover of a given area, which result in increased rates of stormwater runoff and inputs of non-point source pollutants into local streams
- Index of Biological (or *Biotic*) Integrity calculated parameter for assessing the biological health of a given stream (or stream reach) by comparing the condition/status of multiple groups of organisms (e.g., benthic macroinvertebrates, fishes) against the conditions expected to be found in a healthy stream; used to assess the effects of stormwater runoff (or other sources of water quality impairment & habitat degradation) on local stream health, and to help prioritize areas/sites for stream, buffer or wetlands restoration projects
- Local Watershed Planning process whereby local stakeholders (and/or a specific group of local resource agency professionals) are brought together to help EEP assess local watershed conditions, identify causes/sources of watershed impairment, identify high-priority sub-watersheds and mitigation project sites, develop solutions to watershed problems, and implement watershed management strategies for the long term protection of important watershed functions/components (streams, wetlands, riparian buffers); developed by EEP for specific Targeted Local Watersheds within 8-digit CUs where significant impacts are projected to occur.
- Mitigation see *Compensatory Mitigation*
- Modeling the use of conceptual and/or computer models to simulate the response (e.g., pollutant loading to streams) of a natural system (e.g., watershed) to various management scenarios (e.g., adding stormwater retention ponds in critical sub-watersheds). Useful in assessing which types of watershed protection techniques will yield the greatest benefit to water quality, habitat, or flooding conditions, and in determining which locations within the watershed are optimal for such practices or project sites.
- **NPDES** a permit issued for point source (end of pipe) dischargers under the "National Pollutant Discharge Elimination System" [per Section 402 of the Clean Water Act]; also used to regulate stormwater discharges from certain urban areas and developing counties

- **Non-point Source** pollution that enters water bodies from a variety of disperse sources and land use types (generally not end-of-pipe discharges), primarily via overland runoff during and after precipitation events
- Point Source water pollution that can be traced to a single point or a discrete source, such as a wastewater discharge pipe; such sources are much more readily controllable than non-point sources, and are generally regulated via NPDES permits
- **Preservation** the long-term protection of an area with high habitat and/or water quality protection value (e.g., wetland, riparian buffer), generally effected through the purchase or donation of a conservation easement by/to a government agency or non-profit group (e.g., Land Trust); such areas are generally left in their natural state, with minimal human disturbance or land management activities
- Reference Reach (or Condition) ideally, a pristine or relatively undisturbed stream reach (or area of wetlands or riparian buffer) whose physical & biological conditions can serve as a baseline to judge the success of nearby restoration projects and other watershed management efforts
- Resource Professionals staff of state, federal, regional or local (city, county) natural resource agencies including planners, water resources and storm water engineers, parks & recreation departments, water quality programs, regional councils of government, local/regional land trusts or other non-profit groups with knowledge/expertise and/or interest in local watershed issues and initiatives.
- **Restoration** the re-establishment of wetlands or stream hydrology and wetlands vegetation into an area where wetland conditions (or stable streambank and stream channel conditions) have been lost; examples include: stream restoration using natural channel design methods coupled with re-vegetation of the riparian buffer; riparian wetlands restoration through the plugging of ditches, re-connection of adjacent stream channel to the floodplain, and planting of native wetland species; this type of compensatory mitigation project receives the greatest mitigation credit under the 401/404 regulatory framework
- **Riparian** relating to the strip of land adjacent to streams and rivers, including streambanks and adjoining floodplain area; see also *Buffer*; important streamside zones of natural vegetation that, when disturbed or removed, can have serious negative consequences for water quality in streams and rivers
- Sedimentation process whereby eroded soils are deposited in streams, rivers, lakes; accelerated by any activity
 that disturbs the land surface or removes vegetation (e.g., road construction, agriculture/forestry, urban
 development); sediment source areas include upland sites, intermediate slopes, riparian zones, and streambanks
 and channel scour areas
- Stakeholder any agency, organization, or individual involved in or affected by the decisions made in the development of a watershed plan; typically includes: primary stakeholders such as watershed residents, farmers, developers, local government or resource agency staff with a direct say in the planning process; and secondary stakeholders such as state or regional resource agency staff who can serve as technical resources/advisors to the local planning process
- Stormwater water that flows overland as a result of precipitation onto saturated or impermeable surfaces; can flow as diffuse sheet flow over impervious surfaces (e.g., parking lots) and/or can be concentrated into ditches, gullies & swales or manmade conveyances such as storm pipes, culverts, or lined channels; in urban areas or other disturbed landscapes, stormwater can convey sediment, nutrients, fecal coliform and other pollutants directly into receiving waters
- Stream Enhancement Stream rehabilitation activities undertaken to improve water quality or ecological function of a fluvial system. Enhancement activities generally will include some activities that would be required for restoration. These activities may include in-stream or stream-bank activities, but in total fall short of restoring one or more of the geomorphic variables: dimension, pattern and profile. Examples of enhancement activities include stabilization of stream banks through sloping to restore the appropriate dimension and vegetating a riparian zone that is protected from livestock by fencing, construction of structures for the primary purpose of stream bank stabilization and, when appropriate, reattaching a channel to an adjacent floodplain.
- Stream Restoration The process of converting an unstable, altered, or degraded stream corridor, including adjacent riparian zone (buffers) and flood-prone areas, to its natural stable condition considering recent and future watershed conditions. This process should be based on a reference condition/reach for the valley type and includes restoring the appropriate geomorphic dimension (cross-section), pattern (sinuosity), and profile (channel slopes), as well as reestablishing the biological and chemical integrity, including transport of the water and sediment produced by the stream's watershed in order to achieve dynamic equilibrium.

- **Sub-watershed** (or **subwatershed**) a component drainage area within a local watershed (14-digit NRCS hydrologic unit); typically about one to 5 square miles in area, these areas are considered the most appropriate and effective geographic scale for local watershed assessment, planning & management.
- Use Support refers to the DWQ system for classifying surface waters based on their designated best use(s); at present, the DWQ primary stream classifications include the following: class C [fishing/boating & aquatic life propagation]; class B [primary recreation/direct contact]; SA [shellfish harvesting]; and WSW [water supply]. Supplemental classifications include High Quality Waters (HQW), Outstanding Resource Waters (ORW), Nutrient Sensitive Waters (NSW), Trout Waters (Tr), and Swamp Waters (Sw). All waters must at least meet the standards for class C waters.
- Wetlands by definition, these are areas characterized by three key features: hydrophytic (water-adapted) plants, hydric soils, and specific indicators of periodic saturation/indundation by water (hydrology indicators, e.g., water marks or water-carried debris on trees); in NC, several different types of wetlands are recognized, including tidal marshes, estuarine fringe forests, wet flats, pocosins, freshwater marshes, bottomland hardwood forests, headwater forests, bogs, and seeps.
- Watershed all the land area which contributes runoff to a particular point along a stream or river; also known as a "drainage basin", although the term *Basin* usually implies a very large drainage system, as of an entire river and its tributary streams.

APPENDIX B

GIS Data Sets

(Excerpted from Entrix, Inc., 2009. Technical Memorandum 1: Summary of Available Data)

An extensive GIS dataset covering the Indian and Howard's Creeks LWP study area was utilized by EEP, DWQ and Entrix. This dataset included topography data; environmental data such as hydrography, soils, and wetlands; zoning and property address data; land-cover data; base map layers such as roads; aerial photos, parcels, and datasets from the GIS analysis conducted by EEP during Phase I work. GIS analysis datasets compiled or created by EEP are shown in the Table below.

GIS Data Set	Comment
LWP Streams	Stream dataset for the project.
Riparian Impacts	Aerial photos from 2005 were examined by EEP to identify stream segments that were 1000 feet or longer and lacked riparian forest cover. Sites where pasture existed were noted due to the likelihood of cattle assessing the streams. Channelized stream segments were tagged. A GIS layer of impacted sites was created.
Wetland Impacts	Aerial photos from 2005 along with hydric soils and wetlands layers were examined by EEP to identify sites that were ditched, being accessed by cattle, and/or denuded of vegetation. A GIS layer of impacted sites was created.
Stream Preservation	Aerial photos from 2005 were used by EEP to identify sites with the best riparian habitat. These sites were typically 3000 feet or longer with side (<200 feet) forested stream buffers. A GIS layer of potential preservation sites was created.
DWQ Wetland Sites	Sites identified by DWQ and visited in the field as part of their NC WAM for determining wetland preservation opportunities. A GIS layer of potential preservation sites was created.
Parcels	Catawba (2/08), Gaston (2/08), Lincoln (2/08)
Floodplains	EEP Flood Zones from 4-2006
Impaired Waters	Download from DWQ website (1/08)
LWP Streams (in Hydro Geodatabase)	This is the official stream data set for the project. It started with NHD streams. Streams were added, relocated, or adjusted using the 2005 aerial photography. Added streams were generally 1000ft or longer. Contours and aerial evidence were used to locate new streams.
NHD Streams	NHD 24k
Streams - DEM20ac	Synthetic DEM derived streams - Stream Initiation at 20ac
HU Watershed (and LWP Boundary)	14-Digit watershed boundary.
Subwatersheds	Draft Competed 7-2008
DEM	Download from DOT website
and Contours Aerials	NAIP 2006, 1/2 ft Mr.Sid 2005 (These aerials cover the entire study area)
SNHA	Clipped to project area.
NWI	Clipped to project area.

LMCOS Conservation Lands clipped to project area.

Land Cover NC LC-Updated to 2005 (1996 and 2001 also included)

Soils SSURGO Downloads

Hydric Soils

DWQ Wetland

Sites_20080627 Sites identified by DWQ and visited in the field as part of their NC WAM for determining wetland

preservation opportunities.

RipImpacts (in

Hydro Geodatabase) Aerial photos from 2005 were examined to identify stream segments that were 1000 feet or longer and

lacked riparian forest cover. Sites where pasture existed were noted due to the likelihood of cattle accessing the streams and channelized stream segments were tagged. High and Medium Priority sites should be

considered for follow-up fieldwork.

WetImpacts (in

Hydro Geodatabase) Aerial photos from 2005, hydric soils and wetlands were examined to identify sites that were ditched, being

accessed by cattle, and/or denuded of vegetation. High and Medium Priority sites should be considered for

follow-up fieldwork.

StreamPres (in

Hydro Geodatabase) Aerial photos from 2005 were used to identify sites with the best riparian habitat. These sites were typically

3000 feet or longer with wide (< 200ft) forested stream buffers. High Priority Sites (those with a Site

Number) should be considered for follow-up fieldwork